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*Yucca Mountain Site Characterization Project*

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*Site Environmental Report for Calendar Year 2001  
Yucca Mountain Site  
Nye County, Nevada*

*PGM-MGR-EC-000002*

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*U.S. Department of Energy  
Office of Civilian Radioactive Waste Management  
Las Vegas, Nevada*

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## PREFACE

As an operating unit of the U.S. Department of Energy, it is the policy and practice of the Yucca Mountain Site Characterization Project to conduct its operations in a safe and environmentally sound manner. Integration of environmental programs into work activities is also required by the Integrated Safety Management System under DOE Order 5400.4, *Comprehensive Environmental Response, Compensation, and Liability Act Requirements*, and the U.S. Department of Energy has made it clear that protection of the environment and the public is of paramount importance.

In accordance with DOE Order 5400.1, *General Environmental Protection Program*, and DOE Order 231.1, *Environment, Safety and Health Reporting*, the status of the Yucca Mountain Site Characterization Project environmental program has been summarized in this annual Site Environmental Report to characterize performance, confirm compliance with environmental requirements, and highlight significant programs and efforts during calendar year 2001.



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10 October, 2002  
Date



## EXECUTIVE SUMMARY

This Site Environmental Report describes the environmental program conducted for the U.S. Department of Energy Yucca Mountain Site Characterization Office during 2001. It describes the environmental laws and regulations that are applicable to the Yucca Mountain Site Characterization Project, the actions taken to comply with those laws and regulations, the Project's environmental program, and a summary of data collected to monitor potential impacts of the Project on the environment.

**Mission and 2001 Accomplishments**—The major focus of Project activities in 2001 was the documentation of more than two decades of scientific investigations to determine the suitability of the Yucca Mountain site for a geologic repository for high-level radioactive waste and spent nuclear fuel. Highlights of work conducted in 2001 to summarize site characterization and support a site recommendation decision include the following:

- As required by the Nuclear Waste Policy Act, the U.S. Department of Energy held 66 public meetings in Nevada and California to inform residents and obtain comments on site evaluation documents. Comments from these meetings and comments received by mail, e-mail, and other sources were summarized and provided to the Secretary of Energy for consideration in a decision to formally recommend the site.
- In November, the U.S. Department of Energy finalized its repository-siting guidelines to be consistent with the U.S. Environmental Protection Agency's final radiation protection standards for Yucca Mountain and the U.S. Nuclear Regulatory Commission's final licensing requirements for a repository at Yucca Mountain.
- The U.S. Department of Energy issued several major documents. The *Yucca Mountain Science and Engineering Report* (DOE 2001a) summarized scientific and technical information about Yucca Mountain to provide the technical basis for a site recommendation. The *Yucca Mountain Preliminary Site Suitability Evaluation* (DOE 2001b) provided a preliminary assessment of the site's performance against proposed radiation and licensing regulations, and the *FY01 Supplemental Science and Performance Analysis* (BSC 2001a, 2001b) presented recently completed scientific analyses.
- In May, the U.S. Department of Energy issued a *Supplement to the Draft Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2001c). The Supplement updated the description of the repository and evaluated the potential environmental impacts from this newer design. The U.S. Department of Energy held three hearings on the Supplement and received more than 1,900 comments. In addition, work continued on a Final Environmental Impact Statement and associated comment response document.
- Scientific and engineering investigations were conducted to help refine the understanding of how a repository would perform far into the future. These investigations continued to focus on flow and transport in the unsaturated and saturated

zones at Yucca Mountain, testing of the engineered barrier system, and studies of natural analogues to Yucca Mountain.

Based on this and other information, the Secretary of Energy on February 14, 2002, submitted a comprehensive statement to the President recommending the site for development of a repository. As required by the Nuclear Waste Policy Act, this recommendation included a Final Environmental Impact Statement. On February 15, 2002, the President approved the Secretary's recommendation and forwarded it to Congress.

**Environmental Compliance**—During 2001, the Yucca Mountain Site Characterization Project had no violations of environmental permits or noncompliance actions; no reportable occurrences that required notification to a regulatory agency; and no notices of violations, deficiencies, announcements of intent to sue for noncompliance with environmental regulations, or other types of enforcement actions. The following actions were taken during 2001 to maintain environmental permits and comply with environmental regulations:

- A strategic plan was prepared and a gap analysis was conducted for development of an Environmental Management System, as required by Executive Order 13148.
- The U.S. Bureau of Land Management renewed two large Right-of-Way Reservations and extended the period of use for eight small reservations scattered throughout Nevada and California. The U.S. Department of Energy also began reclamation on ten small reservations that were no longer needed for site characterization.
- A borrow pit near Fortymile Wash was reclaimed, and the permit for its use was allowed to expire.
- The U.S. Department of Energy and the U.S. Fish and Wildlife Service completed consultation on the effects of construction, operation, monitoring, and closure of a repository at Yucca Mountain. The U.S. Fish and Wildlife Service concluded that those actions are not likely to jeopardize the continued existence of the desert tortoise.
- A new five-year air quality operating permit was issued by the State of Nevada.
- The annual permit to operate the water supply system at Yucca Mountain was renewed.
- The Project's underground injection permit expired in January. A permit-renewal application had been submitted in 2000, and the State deemed the application to be complete, which allowed the Project to continue working under the existing permit until a new permit is issued.
- A request to extend the period for proof of beneficial use of water from Well VH-1 was filed in April (and approved by the Nevada State Engineer in January 2002). Also in April, the Nevada State Engineer granted the U.S. Department of Energy a two-year waiver authorizing up to about 370 acre-ft of discharge from borehole NC-EWDP-19D. About 5 acre-ft were pumped and discharged to Fortymile Wash from this well in 2001.

- Legal appeals continued on the Nevada State Engineer's ruling against the U.S. Department of Energy's application for a permanent withdrawal of 430 acre-ft per year of groundwater for use at the Yucca Mountain site.

**Environmental Programs**—The following actions were taken as part of the environmental program conducted in 2001 to implement permit requirements, monitor impacts, and protect the environment:

- Nine requests for land access for new or modified activities were reviewed. Complete or partial approval was granted for eight activities, including five scientific studies, one construction project, and two plans for reclaiming disturbed sites. No removal of vegetation, scraping of topsoil, or other permanent habitat disturbances occurred during 2001; thus, the amount of land disturbed by site characterization activities since 1991 remained at 128.8 hectares (318.3 acres).
- No desert tortoises were found during pre-construction surveys and no tortoises were harmed on roads or at Project sites during 2001.
- Final reclamation was completed at 13 sites totaling 4.87 hectares (12.02 acres), and 127 previously reclaimed sites were monitored.
- Archaeological surveys were conducted at six areas proposed for site characterization activities and four sites to be reclaimed. One new archaeological site and five isolated artifacts were identified during those surveys.
- Tribal Update Meetings were held to discuss the environmental impact statement, site recommendation process, and other Project activities.
- Air quality was monitored at 3 sites, and meteorological measurements were taken at 12 sites at Yucca Mountain. Concentrations of airborne particulate matter continued to be far below allowable maximum concentrations. Precipitation during 2001 was about 10 percent below the five-year average.
- Groundwater levels were measured at 40 locations to monitor fluctuations in regional groundwater levels and evaluate potential effects of groundwater withdrawals at Yucca Mountain. Water elevations at these sites were similar to their pre-1994 baseline levels, indicating that Project water withdrawals have had no detectable effect on groundwater levels.
- From 2000 to 2001, there was a reduction of 1,717 pounds in the amount of hazardous waste generated by the Project. Two shipments of hazardous waste totaling 685 pounds, and one shipment of universal waste (mostly fluorescent lamps and nickel-cadmium batteries) totaling 756 pounds, were transported to permitted disposal facilities. As part of the Project's pollution prevention program, numerous materials were recycled or reused.

- To increase vehicle fleet fuel-efficiency, the Project replaced 11 vehicles with small sedans that use compressed natural gas.
- Eight assessments were conducted to evaluate compliance with environmental, safety, and health requirements. In addition, 533 environmental surveillances were conducted to monitor compliance and track environmental performance. Eighteen corrective actions were required for spills and waste management, and 15 corrective actions were required for non-compliance with procedures and plans. Trends in environmental performance indicate continued improvement during 2001.
- Three hundred and seventy-six Project personnel attended initial environmental training required before working unescorted at Yucca Mountain, and 557 took the annual refresher training. When required, Project personnel also were trained in hazardous waste management and transportation and the requirements for detecting and responding to releases of hazardous materials. Managers were required to take a course in environmental compliance awareness.



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## ACRONYMS AND ABBREVIATIONS

### Acronyms

BLM	Bureau of Land Management
BSC	Bechtel SAIC Company, LLC
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	Environment, Safety, and Health
ESF	Exploratory Studies Facility
ISMS	Integrated Safety Management System
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
NWPA	Nuclear Waste Policy Act, as amended
PM <sub>10</sub>	Particulate matter 10 micrometers or less in diameter
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
ROWR	Right-of-Way Reservation
SHPO	State Historic Preservation Officer
U.S.	United States
YMP	Yucca Mountain Site Characterization Project
YMSCO	Yucca Mountain Site Characterization Office

### Abbreviations

cm	centimeters
ft	feet
ha	hectares
in.	inches

## ACRONYMS AND ABBREVIATIONS (Continued)

kg	kilograms
km	kilometers
lbs	pounds
m	meters
mg/l	milligrams per liter
mi	miles
$\mu\text{g}/\text{m}^3$	micrograms per standard cubic meter

## 1. INTRODUCTION

This is the eleventh annual Site Environmental Report prepared by the U.S. Department of Energy (DOE) Yucca Mountain Site Characterization Office (YMSCO). The purpose of this report is to describe the YMSCO environmental program, compliance with environmental standards and requirements, and performance of environmental activities during 2001. As prescribed by the Nuclear Waste Policy Act, as amended (NWPA), the Yucca Mountain Site Characterization Project's (YMP's) environmental program requires (1) that site characterization is conducted in a manner that minimizes significant adverse impacts to the environment, and (2) that the DOE complies with all environmental laws and regulations that are applicable to site characterization.

This report was prepared in accordance with DOE Order 5400.1, *General Environmental Protection Program*; DOE Order 231.1, *Environmental, Safety, and Health Reporting*; and guidance from the DOE Office of Environmental Policy and Assistance (Lawrence 2002). These guidelines emphasize reporting emissions of, and human exposure to, radionuclides and other pollutants and hazardous substances. The YMP has not resulted in any public exposure to non-naturally occurring radionuclides, nor is the YMP a major source of pollutants or hazardous substances. Therefore, this report does not emphasize those topics and differs from the content suggested in the guidance in the following ways:

- This report does not contain a section describing the results of environmental radiological monitoring, radiological doses, or releases from DOE facility operations. The YMP currently does not manage radioactive waste, nor are there any other processes that require monitoring for the release of radioactive materials into the environment. Thus, monitoring the environment or calculating potential doses to offsite or onsite populations is not applicable.
- Sections identified in the guidance as "Environmental Program Information" and "Environmental Non-Radiological Program Information" have been combined as Section 3 of this report. This was done because the monitoring and surveillance data (which the guidance suggests be included in the latter section) are brief and are best understood in the context of the program description.
- The YMP groundwater monitoring program is included in Section 3 (instead of a separate section as suggested by the guidance) because the Project does not release effluents into the groundwater. A description of regional hydrology is included in Section 1.1.3.

Development of this report was not subject to the requirements of the YMP *Quality Assurance Requirements and Description* (DOE 2000a), as determined by Bechtel SAIC Company, LLC (BSC) (BSC 2001c).

### 1.1 SITE DESCRIPTION

The site characterized for a potential repository at Yucca Mountain (or "the site" or "Project site") is on lands administered by the federal government in a remote region of the northern Mojave Desert. It is in Nye County, southcentral Nevada, about 160 kilometers (km) (100 miles [mi]) northwest of Las Vegas, Nevada (Figure 1).

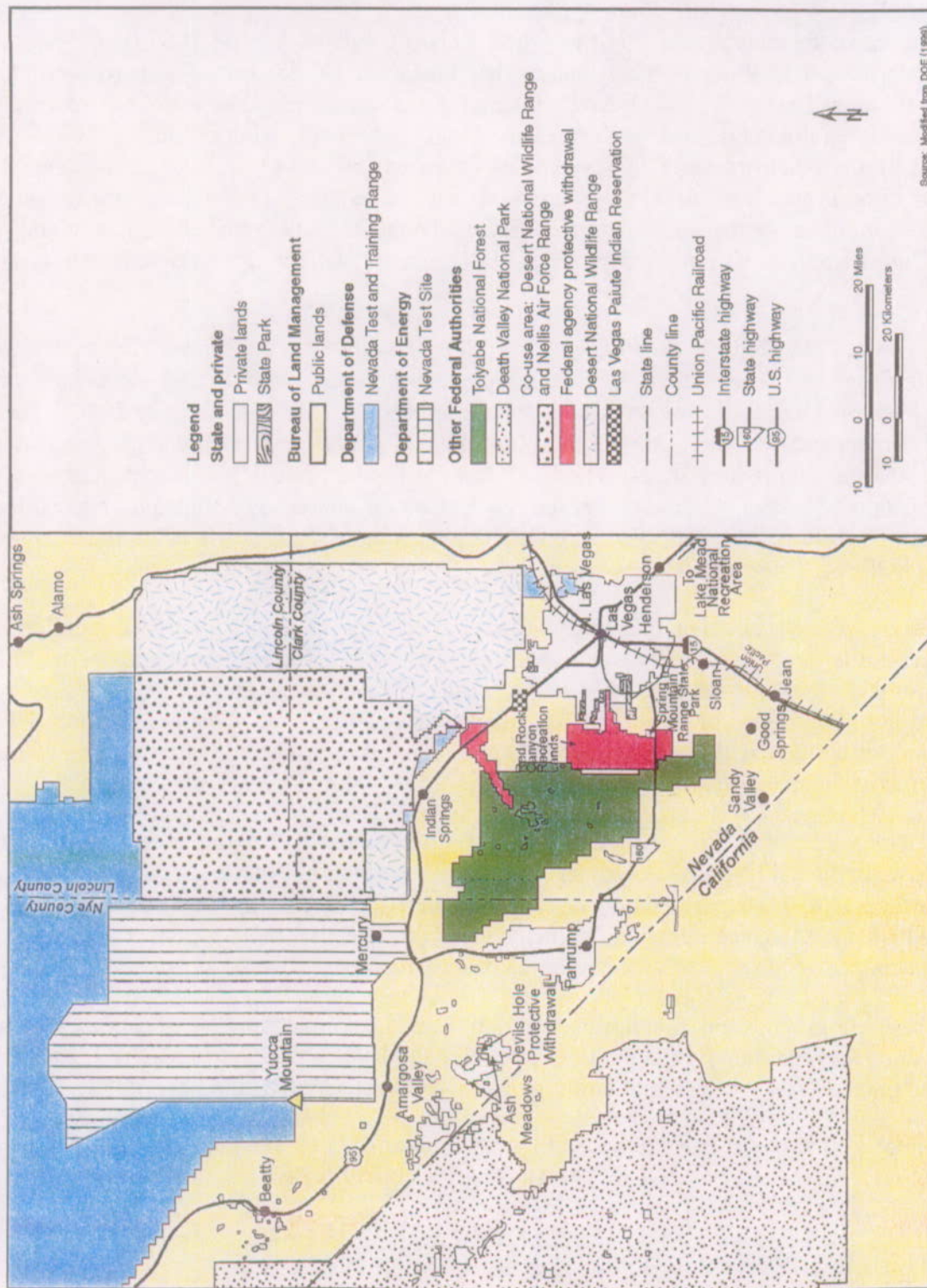


Figure 1. Land Use and Ownership Surrounding Yucca Mountain

Yucca Mountain is an irregularly shaped, north-trending, volcanic upland, 6 to 10 km (4 to 6 mi) wide and 40 km (25 mi) long. The crest of that portion of the mountain being investigated by the DOE has an elevation of 1,400 to 1,510 meters (m) (4,600 to 4,950 feet [ft]). The main ridge in that area slopes steeply to the west into Crater Flat (elevation 1,190 m [3,900 ft]) and gradually eastward to Jackass Flats on the Nevada Test Site (NTS) (elevation 1,100 m [3,600 ft]).

The following sections briefly describe the physical, biological, cultural, and demographic settings of the Yucca Mountain area. More detailed information about the site can be found in the *Yucca Mountain Site Description* (CRWMS M&O 2000) and the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002a).

### **1.1.1 Climate and Meteorology**

Typical of southwestern deserts, the climate at Yucca Mountain is warm and arid to semi-arid (CRWMS M&O 1999a; 2000, Section 2.3). Average maximum and minimum daily temperatures in Midway Valley near the location of the potential repository range from about 22 to 34°C (72 to 93°F) in the summer and about 2 to 10.5°C (34 to 51°F) in the winter. Average annual precipitation at the network of Yucca Mountain meteorological stations ranges from about 10 to 25 centimeters (cm) (4 to 10 inches [in.]), depending on elevation and topography. Annual precipitation varies greatly among years due to differences in regional storm patterns. Occasional periods of persistent or heavy rains, particularly in the winter, have produced more than 5 cm (2 in.) of rain in a day. Summer thunderstorms can drop more than 2.5 cm (1 in.) in a matter of hours, sometimes resulting in flash floods along the usually dry washes that drain Yucca Mountain. Potential evaporation is almost 170 cm (66 in.) per year.

Winds in the region are influenced by nearby mountains and valleys and large-scale weather systems. Winds in the vicinity of Yucca Mountain generally blow to the south or southeast during the day and to the north or northwest at night. Average hourly wind speeds range from 2.6 to 4.3 m per second (5.8 to 9.6 mi per hour), and calm periods are rare. The strongest winds typically occur on exposed ridges. Maximum wind gusts have reached over 38 m per second (85 mi per hour).

### **1.1.2 Geology**

The mountains and valleys visible today in the region of Yucca Mountain formed over the past 15 million years from movement along faults. Rocks and sedimentary deposits in this region range in age from geologically old in some mountains (Precambrian era, or more than 570 million years old) to geologically recent in the valleys (Holocene epoch, or less than 10,000 years old). At Yucca Mountain, most rocks exposed at the surface originated from volcanic eruptions between 11.5 and 14 million years ago.

The oldest and deepest rocks at Yucca Mountain are more than 570 million years old. They occur more than 7.5 km (4.7 mi) below the surface. Overlying these rocks are Paleozoic sedimentary rocks between 225 and 570 million years old. The lower part of these Paleozoic rocks, which are 5 km (3 mi) thick and more than 1.8 km (1.1 mi) below the surface, are part of a regional carbonate aquifer.

The Paleozoic rocks beneath Yucca Mountain are overlain by about 2.5 km (1.6 mi) of volcanic ash-flow tuffs and ashfalls that are widely exposed at the surface. These rocks originated between 11.5 and 14 million years ago (during the Tertiary period) from volcanic centers known as calderas. The eroded remnants of these calderas, some measuring tens of kilometers across, are still visible north of Yucca Mountain.

Overlying the Tertiary volcanic rocks at and surrounding Yucca Mountain are unconsolidated debris known as alluvium and several small cinder cones and basaltic lava flows. These rocks are all younger than 1.6 million years old (Quaternary period). The alluvial deposits developed from erosion of nearby highlands. The alluvium was then transported by water, wind, and gravity to lower elevations. Fans of alluvium form large aprons along the flanks of Yucca Mountain. Most of the alluvial deposits that are visible at the surface in the Yucca Mountain area probably formed within the last 100,000 years. In Crater Flat, west of Yucca Mountain, several small cinder cones and lava flows erupted between 1 million and 3.7 million years ago. The youngest volcanic center in the area is the Lathrop Wells cone, estimated to have erupted about 80,000 years ago. It is located 15 km (9.3 mi) southwest of Yucca Mountain.

Five earthquakes with Richter magnitudes greater than 5.5 have been recorded within 100 km (60 mi) of Yucca Mountain. Except for the Little Skull Mountain earthquake, all occurred near the Death Valley–Furnace Creek fault system more than 50 km (30 mi) south of Yucca Mountain. The Little Skull Mountain earthquake occurred in 1992 about 15 km (9 mi) from Yucca Mountain and had a magnitude of 5.6. Since 1994, seismic events at and near Yucca Mountain have rarely exceeded a magnitude of 3.0 (CRWMS M&O 2000, Section 12.3).

### 1.1.3 Hydrology

Yucca Mountain is within the Alkali Flat–Furnace Creek Groundwater Basin of the Central Death Valley Subregion (Figure 2). This groundwater system is closed; that is, water leaves the system only by evapotranspiration. The primary source of recharge in this area is infiltration of precipitation on Pahute Mesa, Timber Mountain, and Shoshone Mountain in the central part of the subregion, and the Grapevine and Funeral Mountains in the southwestern part of the subregion (D'Agnese et al. 1997) (Figure 2).

Groundwater beneath Yucca Mountain occurs at a depth of 500 to 750 m (1,600 to 2,500 ft) below the surface in volcanic aquifers and in a much deeper carbonate aquifer. This groundwater discharges naturally more than 80 km (50 mi) south of Yucca Mountain at Alkali Flat (Franklin Lake Playa) and in Death Valley (Figure 2) (D'Agnese et al. 1997). Water used by the YMP is pumped from the volcanic aquifers in Crafter Flat and Jackass Flats.

There are no springs, wetlands, or other natural sources of surface water at Yucca Mountain (Hansen et al. 1997). The usually dry washes in the area may contain flowing water after very heavy, sustained rain or snow. On rare occasions, water in the washes flows to the Amargosa River more than 40 km (25 mi) to the south. Although referred to as a "river," the Amargosa is dry along most of its length. Exceptions include short stretches of the river near Beatty, Nevada; Tecopa, California; and southern Death Valley, California, where the river ends in the Badwater Basin, 80 m (260 ft) below sea level (DOE 2002a, Section 3.1.4.1.1).



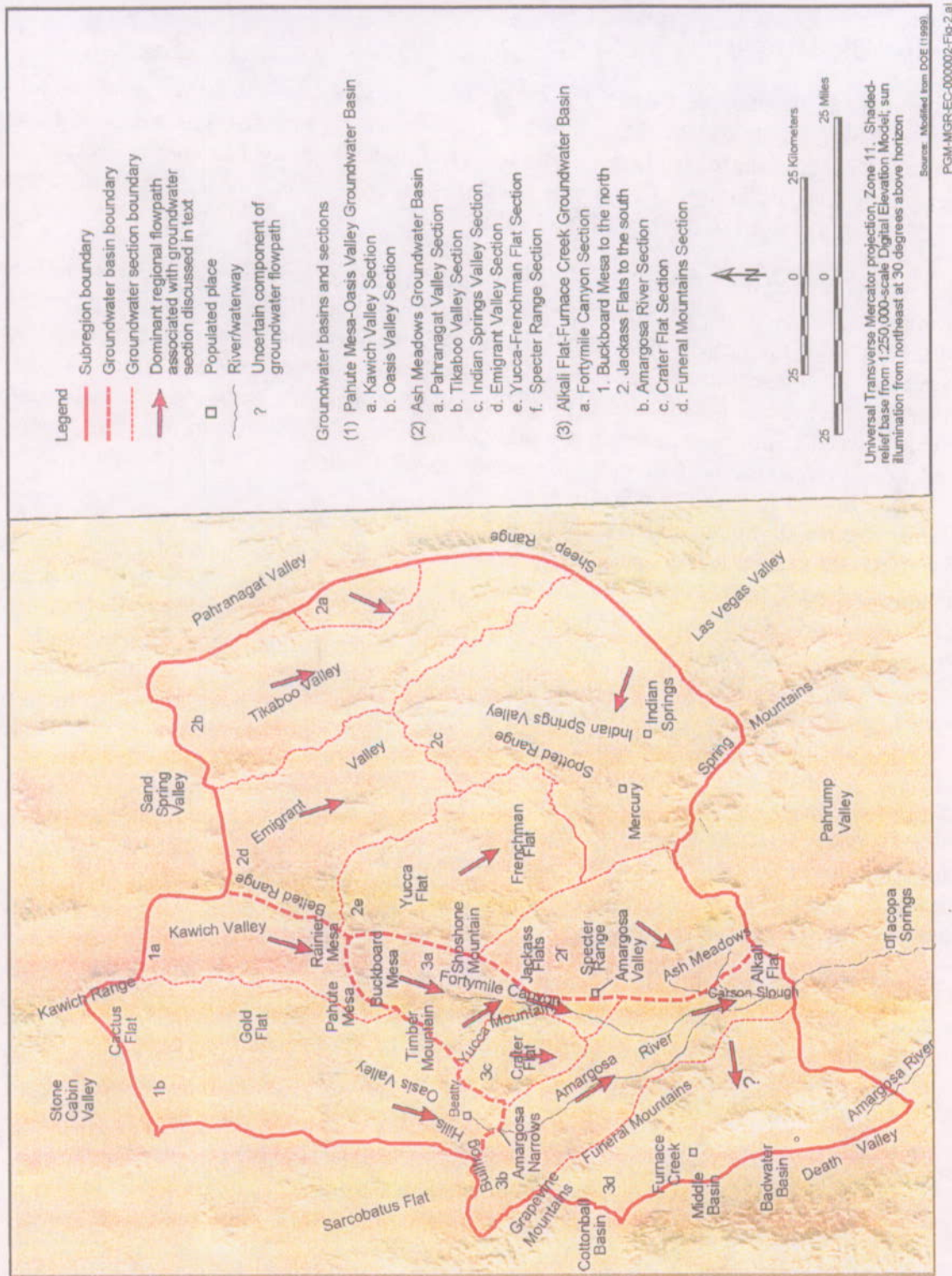


Figure 2. Groundwater Basins in the Vicinity of Yucca Mountain

#### 1.1.4 Biological Resources

Plants typical of the Mojave Desert are most abundant at elevations below about 1,220 m (4,000 ft). Common shrubs include white bursage (*Ambrosia dumosa*), creosotebush (*Larrea tridentata*), Nevada jointfir (*Ephedra nevadensis*), littleleaf ratany (*Krameria erecta*), pale wolfberry (*Lycium pallidum*), California buckwheat (*Eriogonum fasciculatum*), and spiny hopsage (*Grayia spinosa*) (CRWMS M&O 1998a).

Species typical of the Great Basin Desert and the transition zone between the Great Basin Desert and Mojave Desert are most abundant at elevations above about 1,220 m (4000 ft), primarily in the northern part of the Project area. Blackbrush (*Coleogyne ramosissima*) is the most abundant shrub at mid- to high-elevations growing on gentle slopes. Steep slopes at high elevations are dominated by California buckwheat, heathgoldenrod (*Ericameria teretifolius*), Nevada jointfir, broom snakeweed (*Gutierrezia sarothrae*), and green ephedra (*Ephedra viridis*). Big sagebrush (*Artemisia tridentata*) is common on some steep north-facing slopes (CRWMS M&O 1998a).

Thirty-six species of mammals have been recorded at Yucca Mountain, none of which are classified as threatened or endangered. Rodents are the most abundant mammals, with 17 documented species (CRWMS M&O 1997). Seven species of bats have been recorded at Yucca Mountain (CRWMS M&O 1998b). Two of these species, the long-legged myotis (*Myotis volans*) and fringed myotis (*Myotis thysanodes*), are considered sensitive species by the Bureau of Land Management (BLM) in Nevada. Three species of rabbits, seven carnivores, and two ungulates (mule deer [*Odocoileus hemionus*] and feral burros [*Equus asinus*]) also have been seen at Yucca Mountain (CRWMS M&O 1999b).

Twenty-seven species of reptiles have been found at Yucca Mountain, including 12 species of lizards, 14 species of snakes, and 1 species of tortoise (CRWMS M&O 1998c). The desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act (see Section 2.3.1), and the western chuckwalla (*Sauromalus obesus*) is classified as a sensitive species in Nevada by the BLM.

More than 120 species of birds have been seen in the Yucca Mountain region, including 15 species of raptors (CRWMS M&O 1998d). Western burrowing owls (*Speotyto cunicularia hypugaea*), which are uncommon at the site, are classified as sensitive in Nevada by the BLM.

#### 1.1.5 Cultural Resources

Archaeological resources found at and near Yucca Mountain indicate past use by small, mobile groups of aboriginal hunter-gatherers, after which Euroamericans used the area for limited prospecting and, possibly, ranching (DOE 1990, Section 2.4.3). The region may have been inhabited by humans as long as 12,000 years ago. At that time, most activity seems to have centered along major drainages. By 7,000 years ago, a second settlement pattern is discernible, with the establishment of temporary camps in the uplands of Yucca Mountain, some distance from water sources. A third shift in the pattern of settlement occurred about 1,500 years ago, indicated by the presence of sites, often with grinding stones, on alluvial fans or in small rock-shelters in uplands. By that time, sites were no longer being established along major drainages, perhaps indicating that these waterways were dry. Instead, sites were located near



small, seasonal water sources such as depressions in solid rock. A fourth and most recent period of settlement is associated with Euroamericans, indicated by rock cairns, tin cans, and temporary camps (DOE 1990, Section 2.4.3). At the time of the first recorded arrival of Euroamericans in 1849, the area was inhabited by Southern Paiute and Western Shoshone Indians (Stoffle et al. 1990).

Many archaeological surveys have been conducted at Yucca Mountain. As a result, more than 900 historical properties, ranging from single pottery shards to campsites, milling stations, and quarries, have been identified.

#### **1.1.6 Demography**

Nye County and surrounding areas are rural, sparsely populated, and have most residents concentrated in a few small communities. County populations, as determined by the U.S. Census Bureau during the decennial census of April 2000, were as follows: Nye County, Nevada, 32,485 residents; Lincoln County, Nevada, 4,165 residents; Esmeralda County, Nevada, 971 residents; and Inyo County, California, 17,945 residents (U.S. Census Bureau 2001a, 2001b). Estimates of the population within each of these counties during July 2001 were 34,075; 4,198; 978; and 17,944 residents, respectively (U.S. Census Bureau 2002a, 2002b).

To evaluate potential impacts of a repository on the public, the number of people living within a circular area 84 km (52 mi) in radius surrounding Yucca Mountain is tracked. The population in this area was estimated to be 21,845 during the third quarter of 2001 (3.9 people per square km [10.3 per square mi]), with the majority of the population living in or near a few communities (Roe et al. 2001). Within Nye County, the community of Pahrump is split by the southeastern perimeter of the study circle. The estimated population of the portion of Pahrump that lies within the study circle is 17,196. The Amargosa area, including the community of Amargosa Valley, 24–32 km (15–20 mi) south of Yucca Mountain, has an estimated population of 1,401. The area including Beatty, about 32 km (20 mi) west of Yucca Mountain, has an estimated 1,195 residents. In Clark County, the Indian Springs area about 75 km (47 mi) east of Yucca Mountain has an estimated population of 1,481. In Inyo County, California, the estimated population within the study area is 572 in and near Death Valley National Park (Roe et al. 2001). Las Vegas is 160 km (100 mi) to the southeast of the potential repository location, outside of the radiological-monitoring study area.

#### **1.1.7 Land Use**

Land within the Yucca Mountain site is controlled by three federal agencies: the DOE, U.S. Air Force, and the BLM (Figure 1). Public access to DOE and U.S. Air Force lands is restricted. Some off-highway driving and other recreational activities occur on the BLM portion of the site.

Because of a lack of surface water and a very deep groundwater table, there is little agriculture in the region surrounding Yucca Mountain. The nearest farms are in the Amargosa Valley, about 25 km (15 mi) to the south. The Pahrump Valley, about 75 km (47 mi) to the southeast, also has some farming operations. There are a limited number of BLM-issued grazing leases for southern Nye County, although none have been issued for lands at or surrounding the site. There are

several mining operations to the south and west of Yucca Mountain; the closest is a gold mine about 19 km (12 mi) to the west.

Areas south and southwest of the site are popular throughout the year for recreational activities such as camping, hiking, hunting, and nature study. Two that are particularly well known are Ash Meadows National Wildlife Refuge (32 km [20 mi] south) and Death Valley National Park (32–40 km [20–25 mi] southwest).

## **1.2 MISSION AND CURRENT ACTIVITIES**

As directed by the NWPA, the DOE is studying Yucca Mountain to determine if it is a suitable site to build a geologic repository for the nation's commercial and defense spent nuclear fuel and high-level radioactive waste. Congress enacted the NWPA in 1982 in recognition of the need to provide for the permanent disposal of spent nuclear fuel and high-level radioactive waste. The NWPA set forth a policy and schedule for the disposal of these materials in a geologic repository. In 1986, the DOE narrowed the number of potentially acceptable sites to three: Deaf Smith County in Texas, the Hanford site in Washington, and Yucca Mountain. In 1987, Congress amended the NWPA and redirected the DOE to examine only Yucca Mountain. In response to this redirection, the DOE prepared a plan in 1988 to characterize Yucca Mountain (DOE 1988a).

The major focus of activities in 2001 was the documentation of more than two decades of scientific investigations, field tests, and laboratory analyses conducted to determine the suitability of the Yucca Mountain site for a geologic repository. The Secretary of Energy on February 14, 2002, recommended the site to the President for development of a repository. The Secretary forwarded to the President a comprehensive statement for his recommendation, as required by the NWPA, which included a Final Environmental Impact Statement (EIS) (DOE 2002a) and comments from the U.S. Nuclear Regulatory Commission (NRC), Department of the Interior, Council on Environmental Quality, and U.S. Environmental Protection Agency (EPA). On February 15, 2002, the President approved the Secretary's recommendation and forwarded it to Congress. The NWPA gives the State of Nevada an opportunity to disapprove the President's designation within 60 days, which the Governor did in April 2002. During July 2002, Congress passed a joint resolution, which was signed into law, that approved the Yucca Mountain, Nevada site for a repository, as provided by the NWPA.

In February 2001, DOE completed its transition to a new management and operating contractor, BSC. The contract secures services for a five-year period with options up to a total of five additional years. A transition-management team composed of federal staff and personnel from the old and new contractors developed a transition-management plan, procedures for implementation, and an integrated database to house the numerous issues, resolutions, and costs associated with the transition. Approximately 1,600 people, working for one prime contractor with 24 subcontractors and a host of laboratories, were successfully transitioned into one management and operating contract with six subcontracts and support from the national laboratories.

The following is a brief summary of other Project accomplishments during 2001. For additional information, see the annual reports to Congress prepared by the DOE Office of Civilian

Radioactive Waste Management (e.g., *OCRWM Annual Report to Congress FY 2000* [DOE 2001d]) and biannual site characterization progress reports (e.g., *Site Characterization Progress Report: Yucca Mountain, Nevada* [DOE 2001e]).

### **1.2.1 Major Documents Issued in 2001 Supporting a Possible Site Recommendation**

During 2001, the Project issued several major documents in preparation for a possible site recommendation by the Secretary of Energy. These documents are described briefly in this section.

In May 2001, the Project issued the *Yucca Mountain Science and Engineering Report* (DOE 2001a). This report summarized the scientific and technical information developed during more than 20 years of studies of Yucca Mountain, and it formed the technical basis for the site recommendation made in 2002. The report described, among other things, the current design of the repository, the waste forms and packaging proposed for use, the relationship between the waste forms/packaging and the geologic medium of the site, and the data obtained during site characterization activities relating to the safety of the site.

The technical information in the *Yucca Mountain Science and Engineering Report* was evaluated in the *Yucca Mountain Preliminary Site Suitability Evaluation* (DOE 2001b). This evaluation provided a preliminary assessment of the Yucca Mountain site's performance against the proposed radiation protection standards of the EPA and the proposed licensing regulations of the NRC (the EPA finalized its radiation protection standards for Yucca Mountain on June 13, 2001 [66 FR 32074], and the NRC released its final licensing requirements for a repository at Yucca Mountain on November 2, 2001 [66 FR 55732]). The evaluation for both the pre-closure and post-closure periods concluded that the estimated radiation doses from the repository would be below regulatory limits. Together, the *Yucca Mountain Science and Engineering Report* and the *Yucca Mountain Preliminary Site Suitability Evaluation* provided the basis for public comment on a potential recommendation of the Yucca Mountain site.

To be consistent with the *Yucca Mountain Science and Engineering Report*, the DOE issued a *Supplement to the Draft Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Supplement) (DOE 2001c). The Supplement updated the description of the repository that was contained in the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Draft EIS) (DOE 1999). Among the latest design changes described in the Supplement were the inclusion of titanium drip shields to direct any subsurface water away from the waste packages and a redesign of the waste packages. The Supplement described the potential short- and long-term environmental impacts from a repository with this design. It was concluded in the Supplement that the peak mean annual dose at 10,000 years for the nominal scenario with no unexpected natural events or human intrusion would be zero, and the peak mean annual dose after 10,000 years would be lower than the lowest dose scenario described in the Draft EIS. Meanwhile, the DOE continued to work on the Final EIS in 2001 (the Final EIS [DOE 2002a] accompanied the site recommendation made by the Secretary to the President in 2002).

To further analyze uncertainties in the performance assessment, the DOE developed the *FY01 Supplemental Science and Performance Analyses* (BSC 2001a, 2001b). Revised process models were completed to address comments based on technical reviews of earlier reports. Revisions included comprehensive validation and estimation of the spatial uncertainty associated with each of the models. The results of these performance-assessment analyses were a major component of the repository safety case that supported the site recommendation made in 2002.

### **1.2.2 Site Characterization Activities in 2001**

During 2001, DOE continued scientific and engineering investigations at Yucca Mountain to help refine the understanding of how a repository would perform far into the future. These investigations continued to focus on flow and transport in the unsaturated and saturated zones at Yucca Mountain, the engineered barrier system, and natural analogues to Yucca Mountain.

**Investigations of the Unsaturated Zone**—Studies of flow and transport in the unsaturated zone during 2001 continued to focus on improving the understanding of infiltration, flow and seepage, and potential pathways for water to move from the surface to and through the repository horizon. Other investigations examined the origin of secondary calcite and silica deposits, and fluid inclusions in secondary minerals, as indicators of past groundwater movement.

The hub of unsaturated-zone testing was in the Exploratory Studies Facility (ESF), an underground tunnel with a main loop 7.6 m (25 ft) wide and nearly 8 km (5 mi) long. Transecting the main loop is a "cross-drift" tunnel 5 m (16.5 ft) wide and 2.8 km (1.67 mi) long. The cross drift accesses the central and western parts of the potential waste emplacement area.

Project scientists conducted a study in 2001 in the cross-drift tunnel to document the extent of rock fractures induced by the various underground-excavation methods used at Yucca Mountain. Results showed that excavation-induced fractures are minor, extending no more than a few tens of centimeters into the rock.

To better understand how heat generated by the radioactive decay of waste could alter the surrounding rock and waste packages, the drift-scale heater test in Alcove 5 continued in 2001. This test is being carried out in a sealed chamber 48 m (156 ft) long, with a diameter approximately the scale of an actual emplacement drift. Electric heaters, designed to generate heat similar to that expected from the actual spent nuclear fuel waste canisters, were turned on in December of 1997. Driftwall temperatures reached the target temperature of 200°C (392°F) in 2000. Analyses showed that wall temperatures above the boiling point of water reduced the amount of water that reached the emplacement drift. Both temperature and moisture content measured in the test agreed with model predictions. In June 2001, eight new rock samples were obtained from three boreholes to investigate the mineralogic/petrologic response to the thermal-hydrological environment near the boiling zone. Data collected to date indicate that heating had negligible effects on the mechanical and mineralogical properties of the rock matrix, and little impact on the composition of nearby water.

The transport test in the unsaturated zone at Busted Butte continued to quantify the effects of hydrogeologic conditions that are expected at the potential repository site. The test involved tracer injections, laboratory analysis of tracer samples, analysis of rock cores, and numerical

modeling to test conceptual models. Results to date indicate that colloid transport in the unsaturated zone would be much less than in the saturated zone. Long travel distances for any significant volume of colloids through the unsaturated zone is unlikely for large colloids, but there is not enough information to evaluate the transport of small colloids.

Studies of the origin of secondary calcite and silica deposits continued to provide insights about past and present liquid-water flow through the unsaturated zone. The sporadic distribution of secondary mineral deposits on fractures and in cavities was consistent with simulations of fracture flow in the unsaturated zone. Furthermore, the distribution of deposits was inconsistent with a rise in the water table because such a rise would have mineralized all fractures and cavities in the region of flooding. Data from fluid inclusion studies indicate that the rock mass has probably been unsaturated and at near-ambient temperatures for at least the last 2 million years, and possibly as much as 4 million years.

Work continued on a water migration and seepage test along a small fault connecting Crossover Alcove 8 with Niche 3 in the main drift of the ESF. Monitoring of moisture between the bulkheads in the cross drift also continued during 2001 and included measurements of temperature and relative humidity.

Elevated concentrations of chlorine-36 discovered deep within Yucca Mountain suggest the possible existence of fast pathways for water to move from the surface through the repository horizon. The source of the chlorine-36 is attributed primarily to the testing of nuclear weapons in the Pacific Ocean in the 1950s. Studies of the possible existence of these fast pathways continued in 2001.

Isotopic compositions of core-water samples from boreholes USW SD-6 and USW WT-24 obtained in 2001 indicated that relatively young water exists at depth in certain areas of Yucca Mountain. This young water was probably derived from lateral fracture flow from the Solitario Canyon fault to the west, and from recharge north of Yucca Mountain.

**Investigations of the Saturated Zone**—Studies of the saturated zone in 2001 included compilation of borehole logs and geochemical analyses of samples from Nye County drill holes. Hydraulic and tracer testing and radionuclide-transport testing in alluvium continued at the Alluvial Testing Complex.

Other investigations of the saturated zone included compilation of data from Phase II boreholes of the Nye County Early Warning Drilling Program, the development of new geologic cross sections across Fortymile Wash and southern Yucca Mountain, development and refinement of models of the Death Valley regional flow system, and water-level monitoring.

**Testing of the Engineered Barrier System at Yucca Mountain**—Testing of the engineered barrier system focused on ventilation tests to evaluate the design of the repository ventilation system, and on natural convection and thermal conductivity to support the predictions of the heat and temperature distributions in the drifts. Phase 2 of the quarter-scale ventilation test series was completed. Each of the 16 test runs lasted between 3 and 10 days. Data processing is currently in progress, but preliminary results indicate that the ventilation system model being used for design is able to accurately predict test results. Data from this test series establish the credibility

of the model and the Project's ability to design and apply ventilation systems to manage thermal loads in the repository.

Measurements of thermal conductivity were also made in the cross drift during 2001. Results conformed to expected conductivities.

**Studies of Natural Analogues to Yucca Mountain**—Studies of cave systems in Spain and Arizona that are similar to the subsurface setting of Yucca Mountain continued in 2001. These studies suggest that water that may infiltrate to repository depths would stay on the roof and walls of excavations, rather than drip on the waste packages. Furthermore, if relative humidity is kept below 100 percent through ventilation, seepage of liquid water could be further reduced or completely suppressed.

### **1.2.3 Design and Construction**

During 2001, the Project continued to develop requirement documents for the design of the repository. Evaluations continued of a "flexible repository design" that could function over a large thermal operating range. In addition, work and documentation continued on the waste-form and waste-package testing program, enhancement of the materials testing program, and evolution of the repository- and waste-package designs.

The construction of the ESF Niche 5 Collection Wing was completed in 2001. Upgrading of the underground lighting system in the ESF began in 2001 and construction of the ESF Switch Gear Building continued.

### **1.2.4 Repository Performance**

During 2001, the Project updated the assessment of preclosure radiological safety to include an analysis of lower-temperature operating modes and corresponding longer preclosure operating periods. This assessment also contained strategies for criticality safety, radiation protection, fire protection, and management of low-level radioactive waste.

The performance confirmation program began during site characterization and will continue until permanent closure. This program includes activities to collect and analyze performance data to ensure that conditions encountered, and changes in those conditions, are within the limits to be stated in the license application. The performance confirmation program will determine whether the natural systems, engineered systems, and system components function as intended and anticipated. Performance confirmation plans were updated during 2001.

### **1.2.5 Other Activities**

During 2001, the DOE consulted and coordinated with numerous federal, state, and local agencies and Native American tribal organizations in preparation for a possible site recommendation in 2002.

## 2. ENVIRONMENTAL COMPLIANCE

This Section briefly describes the laws and regulations that apply to YMP activities conducted in 2001. It also summarizes actions taken by the YMP to comply with those laws and regulations, lists the environmental permits applicable to YMP activities in 2001 (Table 1), and summarizes permit-related litigation (Section 2.9). Also included is a description of laws and regulations listed in the DOE guidance for development of Site Environmental Reports (Lawrence 2002) that were not applicable to YMP activities in 2001, and an explanation of why they were not applicable.

Prior to 2001, the general applicability of environmental laws and other regulations to the YMP were described in the *Environmental Regulatory Compliance Plan* (YMP 2000a). The contents of that plan have been transferred to the *Yucca Mountain Site Characterization Project Requirements Document (YMP-RD)* (YMP 2001a, Section 7), and the *Environmental Regulatory Compliance Plan* was cancelled in 2001.

During 2001, the YMP had no violations of environmental permits or noncompliance actions; no reportable occurrences that required notification of a regulatory agency; and no notices of violations, deficiencies, announcements of intent to sue, or other types of enforcement actions concerning environmental compliance.

### 2.1 GENERAL REQUIREMENTS

#### 2.1.1 NWPA

The NWPA established a federal policy for the disposal of spent nuclear fuel and high-level radioactive waste in geologic repositories, and assigned to the DOE the responsibility for carrying out that policy. The act, as amended, directs the DOE to determine, through site characterization, whether Yucca Mountain is a suitable site for a repository.

Section 113(a) of the NWPA requires the Secretary of Energy to carry out site characterization activities in a manner that minimizes, to the maximum extent practicable, significant adverse environmental impacts. The YMP therefore has developed a comprehensive and integrated environmental program to ensure compliance with applicable laws and regulations, collect data and monitor impacts of site characterization activities, and minimize those impacts. That program is described in the YMP *Environmental Management Plan* (YMP 2000b).

Table 1. Permits Applicable to YMP Activities in 2001

Regulation Permit Type	Permit Number or Case File	Permit Period	Comments
Materials Act Free Use Permit	N-63370, Borrow Pit #1 N-51530, Coyote Wash Borrow Pit	12/3/99-1/6/08 10/26/90-N/A	Expires when construction ends.
Federal Land Policy & Management Act Right-of-Way Reservations <sup>a</sup>	N-47748 N-48602 N-50250	1/06/88-1/6/08 10/10/89-4/9/04 9/25/90-9/25/02	Renewed January 2001. Renewed January 2001. Extension requested in September 2000.
Public Land Withdrawal Endangered Species Act Biological Opinion	1-5-96-F-307R	7/23/97-N/A	Covers scientific testing and site confirmation prior to repository construction.
NAC 503 Scientific Collection Permit	S19260	1/24/00-12/31/01	New permit obtained in January 2002.
Clean Air Act/NAC 445B Air Quality Operating Permit	AP9611-0573 AP9199-0573.01	4/26/96-4/26/00 7/23/01-7/23/06	Renewal application filed March 2000. Existing permit remained in effect until new permit issued.
Clean Water Act/NAC 445A General Discharge Permit	GNV0022241-30054, Stormwater GNEV9201-40037, Septic Tank	5/14/93-5/14/98 7/12/95-5/12/98	Notice of Intent filed 04/07/98 to continue discharges until 09/30/10. Permit remains in effect until State issues a new permit. Permit remains in effect until State issues a new permit (no renewal application required).
Safe Drinking Water Act/NAC 445A Public Water System Permit Underground Injection Control Permit	NY-0867-12NCNT UNEV89031	4/25/96-9/30/02 1/30/96-1/26/01	Permit renewed annually. Renewal application filed July 2000. Existing permit remains in effect until State issues a new permit.



Table 1. Permits Applicable to YMP Activities in 2001 (Continued)

Regulation Permit Type	Permit Number or Case File	Permit Period	Comments
NRS 533 Water Appropriation Permits	57373, J-12	4/2/92-4/9/02	Permanent water right. Period for proof of beneficial use extended in 2002.
	57374, J-13	4/2/92-4/9/02	
	57376, J-13	4/2/92-4/9/02	
	57375, VH-1	4/2/92-N/A	
	58827, UE-25C#1	5/13/93-4/9/02	
	58828, UE-25C#3	5/13/93-4/9/02	
	58829, UE-25C#2	5/13/93-4/9/02	
NAC 477 Hazardous Materials Storage Permit	Waivers for borehole NC-EWDP-19D	4/26/00-4/25/03	Permit reissued annually.
	13-00-0073-X	3/1/00-2/28/01	
	13-01-0073-X	3/1/01-2/28/02	

NOTES: <sup>a</sup> List does not include 22 Right-of-Way Reservations for small sites in Nevada and southern California, 11 of which were relinquished or transferred in 2001.

As described in Section 1.2.1, several major documents were issued for the Project during 2001 in preparation for a possible site recommendation by the Secretary of Energy. On February 14, 2002, the Secretary of Energy recommended the site to the President for development of a repository, and on February 15, 2002, the President approved the Secretary's recommendation and forwarded it to Congress (see the beginning of Section 1.2 for more information about the site recommendation). As required by Section 114(a)(1) of the NWPA, DOE held hearings in the vicinity of Yucca Mountain to inform residents in the area and to receive their comments regarding the Secretary's consideration of whether to recommend Yucca Mountain as a site for the Nation's first repository for spent nuclear fuel and high-level radioactive waste. On May 4, 2001, DOE began receiving public comments on the Secretary's consideration of the possible recommendation of the Yucca Mountain site. The public comment period was extended twice, to October 19, 2001. Subsequently, the public comment period was reopened from November 14 to December 14, 2001, to provide the public with an opportunity to comment on final rulemakings by EPA, NRC, and DOE.

On June 13, 2001, the EPA finalized its radiation protection standards for Yucca Mountain (40 CFR 197). NRC released its final licensing requirements for a repository at Yucca Mountain on November 2, 2001, by incorporating EPA's standards (10 CFR 63). And on November 14, 2001, DOE finalized its repository-siting guidelines to be consistent with both 40 CFR 197 and 10 CFR 63 (10 CFR 963).

In all, 66 hearings were held in locations across Nevada and in Inyo County, California. Comments received at the hearings and through other public comment channels (e.g., U.S. Postal Service) were categorized and were addressed in a *Site Recommendation Comment Summary Document* (DOE 2002b). The Secretary considered the comments received during this period before making his recommendation to the President on February 14, 2002, to approve the site for development of a repository.

### **2.1.2 National Environmental Policy Act**

The National Environmental Policy Act (NEPA), and the regulations that implement the act (40 CFR 1500), establish a process that federal agencies must follow to evaluate and document the potential beneficial and adverse consequences of proposed major federal actions on the human and natural environments. Those evaluations are conducted to assist agencies in making informed decisions about their proposed actions. DOE has developed regulations (10 CFR 1021) for implementing NEPA requirements and to ensure compliance with 35 FR 4247, Protection and Enhancement of Environmental Quality (Executive Order [EO] 11514).

The NWPA includes several stipulations about how NEPA applies to activities at Yucca Mountain. Section 112(b) required the Secretary of Energy to prepare an Environmental Assessment prior to nominating a site as suitable for site characterization. The Assessment for Yucca Mountain was released in 1986 (DOE 1986). Section 113(d) of the NWPA states that site characterization activities are preliminary decision-making activities; therefore, an EIS was not required for site characterization activities conducted in 2001 or in previous years.

Section 114(f) of the NWPA requires that a Final EIS be prepared and included with any recommendation to the President to approve a site as a repository. Therefore, the YMSCO

published a Notice of Intent (60 FR 40164) in 1995 stating its intention to prepare an EIS and to solicit public comments on its scope. The DOE completed the Draft EIS in 1999 (DOE 1999). As required by the NWPA, the Final EIS (DOE 2002a) was submitted with the Secretary of Energy's site recommendation to the President on February 14, 2002 (see the beginning of Section 1.2 for more information about the site recommendation).

In May 2001, the DOE released a Supplement to the Draft EIS (DOE 2001c). The Supplement updated the description of the repository that was contained in the Draft EIS (DOE 1999) and described the potential short- and long-term environmental impacts from this newer design. Public hearings on the Supplement were held in Amargosa Valley on May 31, 2001; in Las Vegas on June 5, 2001; and in Pahrump on June 7, 2001. DOE received 1,913 comments on the Supplement.

During the remainder of 2001, DOE continued work on the Final EIS, including a comment response document that considers all comments received on both the Draft EIS and the Supplement. On February 14, 2002, the Secretary of Energy recommended the site to the President for development of a repository. As required by the NWPA, this recommendation included a Final EIS (DOE 2002a).

In accordance with DOE Order 451.1, *National Environmental Policy Act Compliance Program*, an annual summary of NEPA activities conducted by the YMSCO during 2001 and planned for 2002 was completed in 2002 (Milner 2002).

### **2.1.3 Atomic Energy Act**

The Atomic Energy Act, as amended, provides fundamental jurisdictional authority to DOE and the NRC over governmental and commercial use of nuclear materials. The act ensures proper management, production, possession, and use of radioactive materials. It grants DOE the authority to develop generally applicable standards for protecting the environment from radioactive materials. In accordance with the Atomic Energy Act, DOE has established a system of requirements that it has issued as DOE Orders and codified federal regulations.

There are no work processes for the YMP that require the monitoring of radioactive effluents into the environment. The Project maintains an inventory of sealed instrument check sources and moisture/density tools for moisture/density measurements and some limited well-logging activities. During 2001, the YMP continued to disposition radioactive sources no longer used or needed.

### **2.1.4 EO 13148, Greening the Government Through Leadership in Environmental Management**

EO 13148 (65 FR 24595) requires integration of environmental accountability into federal agency day-to-day decision making and long-term planning processes. One goal of EO 13148 is to ensure that strategies are established to support environmental leadership programs, policies, and procedures by requiring the implementation of Environmental Management Systems (EMSs) at all appropriate federal facilities by December 31, 2005. To achieve that goal, EO 13148 also required that federal agencies conduct a one-time EMS self-assessment by October 2001.

In 2001, the Secretary of Energy issued DOE Notice 450.4, *Assignment of Responsibilities for Executive Order 13148, Greening the Government Through Leadership in Environmental Management*. This Notice established applicability, requirements, and responsibilities for implementing EO 13148 within the DOE. The provisions of DOE Notice 450.4 apply to all DOE elements responsible for oversight of contracts for the management and operation of Department facilities and to all contractors. The Notice established the requirements for implementation of an EMS at DOE facilities as part of an Integrated Safety Management System (ISMS). Various levels within DOE also were assigned responsibilities for conducting a one-time EMS self assessment.

Several actions were taken in 2001 to implement the EMS requirement in EO 13148 and DOE Notice 450.4. The YMP participated in the one-time EMS self assessment regarding implementation of an EMS. That response stated that an EMS had not been implemented for the YMP, but that methods and approaches for implementation were being developed. It also stated that two elements of an EMS, identifying legal requirements and conducting periodic regulatory-compliance audits, were being performed.

A strategic plan (Sorensen 2001a) was prepared in 2001 for development and implementation of an EMS based on International Organization for Standards 14001 (ISO 14001), which is the international standard for EMSs. A self-assessment (i.e., gap analysis) of current Project environmental management practices against those standards was conducted from September through December 2001 and documented in March 2002 (Sorensen 2002). It was concluded that 12 of 17 criteria in the standard were being fully implemented, and improvements to processes were needed for full implementation of the remaining 5 criteria.

Other parts of the YMP environmental program comply with other requirements of EO 13148. For example, the YMSCO requires reviews of all requests for authorization to purchase and use chemicals to ensure that the least hazardous materials are selected for use and that the possibility of releases of toxic chemicals is reduced or eliminated. Whenever possible, waste streams are reduced using recycling and source reduction (see Section 3.8.2). Environmental compliance is assessed through formal assessments (see Section 3.9) and surveillances (see Section 3.10). Environmental accountability is integrated into daily functions and planning as part of the YMP ISMS and by instilling environmental and pollution prevention awareness into employees during training programs (see Section 3.11). Protection of resources on YMP-controlled land is achieved through YMP land access reviews (see Section 3.1), biological surveys and reclamation (see Sections 3.2 and 3.3), identification and conservation of cultural resources (see Section 3.4), environmental regulatory compliance (see Sections 3.5 through 3.8), and surveillance and assessment programs (see Sections 3.10 and 3.11).

#### **2.1.5 EO 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition**

This EO (63 FR 49643) establishes purchasing guidelines and reporting requirements for federal agencies. It expands and strengthens the federal government's commitment to recycling and requires that, when possible, federal agencies procure environmentally preferable products and services and purchase recycled-content products identified by the EPA. The YMP affirmative procurement program is described in Section 3.8.3.

## **2.1.6 EO 13123, Greening the Government Through Efficient Energy Management**

EO 13123 (64 FR 30851) requires federal facilities to reduce emissions of greenhouse gases, improve energy efficiency and water conservation, and expand the use of renewable energy. This EO requires that sustainable-design principles be applied to the siting, design, and construction of new facilities. The Project's efforts to comply with this EO are described in Section 3.8.

## **2.1.7 EO 13149, Greening the Government Through Federal Fleet and Transportation Efficiency**

EO 13149 (65 FR 24607) requires federal facilities to reduce the consumption of petroleum fuels through the use of alternative fuels and the acquisition of higher fuel-economy vehicles. The purchase and use of environmentally preferable automotive products, such as retread tires and re-refined motor oils, is also required by EO 13101. As described in Section 3.8.3, efforts to implement EO 13149 on the YMP to date include the purchase of fuel-efficient and alternative-fuel vehicles and the purchase of retread tires for large trucks and heavy equipment.

## **2.2 LAND USE**

### **2.2.1 Federal Land Policy and Management Act**

The Federal Land Policy and Management Act establishes United States (U.S.) policy for government-owned lands administered by the BLM, and mandates that these lands be managed in a manner that will protect environmental quality, preserve certain lands in their natural condition, and provide for outdoor recreation and human occupancy and use. Because some YMP activities are conducted on BLM-administered public land, the YMSCO must comply with BLM requirements for access to and use of that land.

Access for site characterization activities on BLM-administered land and U.S. Air Force-administered BLM land at Yucca Mountain was granted in Right-of-Way Reservations (ROWRs) issued in January 1988 and June 1994, respectively (BLM 1988, 1994). Both ROWRs were renewed for seven years in January 2001 (Wells 2001a, 2001b, 2001c). The ROWR for U.S. Air Force-administered BLM land will require additional concurrence from the U.S. Air Force and a Notice to Proceed from the BLM by January 2004 (Wells 2001c).

The BLM also has withdrawn public lands at Yucca Mountain from the mining and mineral-leasing laws. The 1,722-hectare (ha) (4,255.50-acre) withdrawal overlays part of the BLM-administered land previously discussed, and was obtained to preclude degradation of the potential repository block from mining. This withdrawal was obtained in 1990 and expires September 25, 2002 (55 FR 39152). An application to extend the length of the withdrawal was filed with the BLM in August 2000 (Dyer 2000).

The YMSCO has also acquired 45 ROWRs from the BLM for sites scattered throughout Nevada and southern California where seismic, radiation, or streamflow monitoring stations were established or where pits have been developed to study volcanism and faulting. Most of these sites are small (i.e., less than 0.125 ha). Twenty-two of these ROWRs were still active at the

beginning of 2001. During the year, 8 of the 22 were extended; 1 was transferred to the University of Nevada, Reno. Seismology Laboratory; and 10 were relinquished.

All BLM ROWRs require that the YMP comply with applicable environmental laws and regulations. Environmental program activities described in Section 3 are therefore conducted on all ROWRs, as applicable. BLM also requires the DOE to recontour and revegetate disturbed sites before relinquishing them, and to monitor growth of vegetation on those sites until reclamation success criteria are achieved. As described in Section 3.3, the YMP conducted reclamation when applicable and as agreed upon with the BLM at sites relinquished in 2001.

### **2.2.2 Materials Act**

The Materials Act authorizes the BLM and other land management agencies to issue free-use permits to federal and state agencies for use of common varieties of sand, stone, and gravel on public lands. Since 1990, the BLM has issued the YMP three free-use permits to excavate sand and gravel. One of the permits is for a borrow pit in Coyote Wash that has not been developed. The second permit, for a borrow pit near Fortymile Wash, was allowed to expire in 2001 after recontouring and reclamation had been completed. The third, for Borrow Pit #1 east of Fran Ridge, was to expire in 2001, so the YMSCO applied to the BLM for a renewal in 1999. A renewal of that permit, valid for seven years, was granted in February 2000 (Drais 2000). As described in the annual report to the BLM, 1,736 cubic m (2,077 cubic yards) of material were removed from that pit in 2001 (Wade 2001a).

## **2.3 BIOLOGICAL RESOURCES**

### **2.3.1 Endangered Species Act**

The Endangered Species Act requires federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that their actions do not jeopardize the continued existence of threatened or endangered species, or destroy or adversely modify their critical habitats. This act also prohibits killing, injuring, or otherwise taking a threatened or endangered species, unless that taking is incidental to an otherwise lawful act and conducted in accordance with an incidental take provision issued by the Service. The desert tortoise is the only threatened or endangered species at Yucca Mountain; the site is not classified as critical habitat for this threatened species.

The YMSCO initially consulted with the U.S. Fish and Wildlife Service about the effects of site characterization activities on desert tortoises in 1989. In 1996, the YMSCO reinitiated formal consultation to allow the Service to clarify its interpretation of take, revise the incidental take limit, and re-evaluate terms and conditions for relocating tortoises. In a 1997 biological opinion, the Service again concluded that it was unlikely that completion of site characterization, performance confirmation, and related activities would jeopardize the species, and they revised the terms and conditions the YMP must follow to legally and incidentally take desert tortoises (Buchanan 1997). That biological opinion and incidental take provision were applicable to all YMP activities conducted during 2001.

The 1997 incidental take provision requires that the YMP minimize harm to tortoises by conducting preactivity and clearance surveys, removing tortoises and tortoise nests from construction sites, designing and monitoring escapable trenches, controlling litter, setting speed

limits, reclaiming habitat, and implementing a worker-education program. Many parts of the integrated environmental program described in Section 3 are conducted to comply with these requirements. For example, litter control, design of trenches, and other requirements are incorporated into projects during land access evaluations (Section 3.1). Surveys are conducted to find and protect tortoises (Section 3.2). Reclamation of desert tortoise habitat is conducted as described in Section 3.3. The training program described in Section 3.11 includes information about the conservation and protection of desert tortoises.

No desert tortoises were killed or injured by site characterization activities during 2001. An annual report of activities conducted to comply with the incidental take provision was submitted to the U.S. Fish and Wildlife Service in February 2002 (Wade 2002a).

The YMSCO and U.S. Fish and Wildlife Service completed consultation during 2001 on the effects of construction, operation, monitoring, and closure of a geological repository at Yucca Mountain. The U.S. Fish and Wildlife Service concluded that those actions are not likely to jeopardize the continued existence of the desert tortoise. The resulting biological opinion (Williams 2001) would take effect only if construction of repository facilities is authorized. The YMP will continue to rely upon the 1997 biological opinion (Buchanan 1997) to comply with the Endangered Species Act for all future scientific testing, site confirmation, and similar activities that occur prior to any authorization to construct a repository.

### **2.3.2 Migratory Bird Treaty Act**

The Migratory Bird Treaty Act implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Taking, killing, or possessing migratory birds is unlawful under this act unless permitted by the U.S. Fish and Wildlife Service.

Surveys at Yucca Mountain are conducted before clearing vegetation (see Section 3.2), in part to ensure that migratory birds are not harmed during those activities. In addition, facilities such as water tanks are inspected during surveillances (see Section 3.10) to ensure that migratory birds are not being trapped or otherwise harmed.

### **2.3.3 Nevada State Wildlife Statutes**

NAC 503, Hunting, Fishing and Trapping; Miscellaneous Protective Measures, prohibits capturing or harming species classified as protected by the State without a permit. The desert tortoise is classified in Nevada as threatened with extinction and has been placed on the State list of fully protected species. Because the YMP is required to remove desert tortoises that may be harmed by Project activities, BSC maintains a permit issued by the Nevada Division of Wildlife for the capture and relocation of desert tortoises (Nevada Division of Wildlife 2000). That permit also allows BSC to capture and possess other species for wildlife monitoring studies at Yucca Mountain. No tortoises or other wildlife were captured or possessed under this permit in 2001. An annual report was submitted to the Nevada Division of Wildlife in January 2002 (Green 2002). A renewal of that permit was obtained in January 2002 (Nevada Division of Wildlife 2002).

### 2.3.4 EO 13112, Invasive Species

EO 13112 (64 FR 6183) was developed to prevent and control the introduction of invasive, non-native species to minimize economic, ecological, and human-health impacts. Applicable portions of the EO require the YMP to prevent the introduction of invasive species; monitor and control those species; restore native species; and exercise care when taking actions that could promote the introduction or spread of invasive species.

In part to implement this EO, disturbed sites are revegetated as soon as possible after decommissioning to reduce the time available for invasive plant species to become established. Native perennial species are seeded or planted during reclamation to reduce colonization of invasive plants. The abundance of non-native species on reclaimed sites is then monitored periodically, and control efforts such as weeding, re-seeding of native perennials, or application of herbicide may be implemented to reduce the abundance of invasive species. As described in Section 3.3.3, 13 sites totaling 4.87 ha (12.02 acres) were reclaimed in 2001 and 127 previously reclaimed sites were monitored.

## 2.4 CULTURAL RESOURCES

The National Historic Preservation Act is the principal law regulating the protection of historic properties and cultural resources at Yucca Mountain. Others include the Archaeological Resources Protection Act; Antiquities Act; American Indian Religious Freedom Act; Native American Graves Protection and Repatriation Act; and 36 CFR 79, Parks, Forests, and Public Property: Curation of Federally-Owned and Administered Archaeological Collections. In addition, the YMP operates to EO 11593, Protection and Enhancement of the Cultural Environment (36 FR 8921); EO 13007, Indian Sacred Sites (61 FR 26771); EO 13084, Consultation and Coordination with Indian Tribal Governments (63 FR 27655); and the DOE *American Indian and Alaska Native Government Policy* (DOE 2000b). Many of these regulations address cultural values and beliefs of Native Americans, and protect and preserve their religious rights and practices. The goals of these laws are to ensure that historic properties and cultural values are considered when planning and conducting federal activities, and that adverse effects on significant historic properties and matters of concern to Native Americans are identified and mitigated.

Compliance with most of these statutes, regulations, and EOs is accomplished through a *Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation for the Nuclear Waste Deep Geologic Repository Program Yucca Mountain, Nevada* (Programmatic Agreement) (DOE 1988b), which was executed between the DOE and the Advisory Council on Historic Preservation. The Programmatic Agreement requires the YMP to give the Nevada State Historic Preservation Officer (SHPO) the opportunity to participate in monitoring compliance with the Agreement. Although the SHPO is not a signatory to the Programmatic Agreement, the DOE has invited the SHPO to participate. The YMP sends copies of all survey reports, data recovery plans, and annual reports to the SHPO. In 2001, representatives of the SHPO actively participated in oversight and review of the program, making an initial visit to archaeological sites at Yucca Mountain, commenting on numerous survey reports, and engaging in discussions of future work plans at Yucca Mountain.



The Programmatic Agreement also required the YMP to develop and implement a comprehensive research plan for recovering, documenting, and interpreting data from historical properties. The *Research Design and Data Recovery Plan for Yucca Mountain Project* (DOE 1990) was developed and implemented to meet that requirement. Activities conducted in 2001 to implement that plan are described in Section 3.4.1.

All personnel working at Yucca Mountain must be informed of their responsibilities for protecting archaeological resources. That training is described in Section 3.11.

To comply with the Programmatic Agreement, the YMP also must consult with certain Native American tribes and organizations regarding religious and cultural concerns about historical properties. The YMSCO therefore conducts a Native American Interaction Program with 16 tribes and one Native American organization that have traditional ties to the Yucca Mountain area. Interactions conducted during 2001 are described in Section 3.4.3.

Finally, the YMP must provide the SHPO and the Advisory Council on Historic Preservation with regular reports concerning implementation of the Programmatic Agreement. A report summarizing activities conducted by the DOE and its support contractors to implement the stipulations of the Programmatic Agreement during calendar year 2001 was submitted in 2002 (Wade 2002b).

## **2.5 AIR QUALITY**

Activities affecting air quality at Yucca Mountain are regulated by the Clean Air Act. That act requires, among other things, compliance with national air quality standards, permits for operating air pollution sources, and limits on emissions of certain hazardous air pollutants.

40 CFR 63, Protection of Environment: National Emission Standards for Hazardous Air Pollutants for Source Categories, promulgated by the EPA did not apply to YMP activities conducted in 2001. These federal regulations set forth emission limits and other requirements for activities that generate emissions of certain types of hazardous air pollutants. No pollutants covered by these regulations have been emitted by YMP activities to date.

The Nevada Division of Environmental Protection is responsible for implementing and enforcing most other requirements of the Clean Air Act in Nevada. State regulations (NAC 445B, Air Controls) require an air quality operating permit for large generators and other point sources of air pollution and for activities that are projected to disturb more than 8.1 ha (20 acres). The YMSCO has held an operating permit for land disturbances since 1991 and has obtained permits, as needed, for the operation of generators and other emission sources. In mid-1995, the State consolidated those permits into a single Class II air quality operating permit (Johnson 1995).

The Project's air quality operating permit expired on April 26, 2000. As required, the YMSCO submitted a permit renewal application (Wade 2000a), which was deemed complete by the Nevada Division of Environmental Protection. As provided in Nevada regulations, the YMP continued to operate legally under the expired permit until a new Class II air quality operating permit was issued on July 23, 2001 (Elges 2001).

Ten systems (i.e., generators and other emission sources) were permitted under the new air quality operating permit. As required, an annual report summarizing emissions during 2001 was submitted to the Nevada Division of Environmental Protection in February 2002 (Wade 2002c).

Due to a reduction in site activities, only 0.01 metric tons (0.01 tons) of reportable air pollutants were emitted from the ten permitted systems during 2001. The maximum allowed under a Class II permit is 91 metric tons (100 tons).

The air quality operating permit requires the YMP to control fugitive dust. This was done throughout 2001 by applying water or state-approved chemical stabilizers to disturbed areas. In addition, disturbed areas no longer required for the YMP were reclaimed (Section 3.3).

Prior to 1999, the air quality operating permit stipulated that the DOE must sample ambient air for inhalable particulate matter 10 micrometers or less in diameter (PM<sub>10</sub>). Although no longer required by the permit, the YMP continues to monitor PM<sub>10</sub> at three sites because of its importance in establishing trends and detecting changes in air quality. Section 3.5 describes that program and the results of monitoring in 2001.

The Clean Air Act also regulates the service, maintenance and repair, and disposal of appliances and air conditioning systems from motor vehicles that contain Class I and Class II ozone-depleting substances (40 CFR 82). Technicians working on the YMP that repair or service those systems are certified and follow procedures to minimize releases of ozone-depleting substances.

## **2.6 WATER QUALITY AND AVAILABILITY**

### **2.6.1 Clean Water Act**

The Clean Water Act, as amended, establishes federal policy for restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Regulations that implement the act address effluent discharges, water quality standards, and discharges of oil and hazardous substances into surface water. Only those parts of the act that regulate discharge of liquid effluents to the surface (including stormwater) and discharge of dredged or fill material were applicable to the YMP in 2001.

Permits to discharge liquid effluents are issued pursuant to the National Pollutant Discharge Elimination System (40 CFR 122). Implementation and enforcement of this portion of the Clean Water Act are delegated to the Nevada Division of Environmental Protection (NAC 445A, Water Controls). During 2001, the YMP operated under general discharge permits issued in May 1993 for stormwater discharges (Brandmueller 1994) and July 1995 for sanitary sewage discharges to a septic tank and leachfield (Saunders 1995). These permits expired in 1998, but the Nevada Division of Environmental Protection has stated that they will remain in effect until new permits are issued. An assessment of stormwater management practices was conducted in 2001.

Section 404 of the Clean Water Act requires that a permit be obtained from the U.S. Army Corps of Engineers prior to placing dredged or fill materials into washes that are classified as waters of the U.S. (33 CFR 320). To ensure compliance with this requirement, all new surface-disturbing

activities are evaluated as part of the land access process (see Section 3.1). One activity conducted in 2001 required that fill material be placed in a dry wash that may be classified as a water of the U.S. That activity was allowed by Nationwide Permit 5, Scientific Measurement Devices, issued by the U.S. Army Corps of Engineers in 1996 (61 FR 65874) (see Section 3.2).

## **2.6.2 Safe Drinking Water Act**

The Safe Drinking Water Act gives the EPA responsibility and authority to regulate public drinking water supplies by establishing drinking water standards, delegating to states the authority for enforcing those standards, and protecting aquifers from such things as injection of wastes and other materials into wells.

The Nevada Bureau of Health Protection Services, Division of Health, enforces drinking water standards (NAC 445A). The water supply system at Yucca Mountain is classified as a public water supply, and an annual permit to operate that system was first granted in April 1996. That permit was renewed in September 2000 (Nevada State Division of Health 2000) and September 2001 (Nevada State Division of Health 2001). All drinking water for the site comes from wells J-12 and J-13.

As required by these permits, coliform sampling was conducted quarterly; all samples were negative. The YMP also completed annual sampling for nitrate, fluoride, lead, and copper. All constituents except fluoride (see next paragraph) were below the primary (40 CFR 141) and secondary (40 CFR 143) drinking water standards. Sampling and other activities conducted during 2001 to comply with the permit are summarized in a report submitted to the Nevada Division of Health in January 2002 (Wade 2002d).

In November 2001, an annual notice was posted informing employees of elevated fluoride levels in the drinking water system at Yucca Mountain. The notice is required because the average concentration of fluoride, which is a naturally occurring element in the groundwater at Yucca Mountain, was 2.15 milligrams per liter (mg/l), which exceeds the Nevada secondary drinking water standard for fluoride of 2.0 mg/l. However, the concentration was below the primary drinking water standard of 4.0 mg/l. Annual sampling for fluoride will continue, and the results of that testing will be made available to YMP employees.

Another component of the Safe Water Drinking Act applicable to the YMP in 2001 was the underground injection control program (40 CFR 144). This program was established to prevent contamination of underground sources of drinking water from improper design, construction, and operation of injection wells. The State of Nevada has EPA-granted authority to administer this program (NAC 445A), which requires a permit before tracers can be injected into drillholes or used in infiltration studies. To comply with this program, the YMP has a permit (Land 1998), issued by the Nevada Division of Environmental Protection, that authorizes injection of water and various tracers, including gas (but excluding ozone-depleting substances), into 103 boreholes; surface discharges from the fire suppression pond, concrete batch plant, and infiltration basin; and use of filtered mine waste water for dust suppression.

As required by the underground injection control permit, quarterly reports are submitted to the Nevada Division of Environmental Protection. These reports include the volume of fluid

produced or discharged per month; the type, quantity, and concentration of tracer(s) injected per month; tracer test summaries; the results of chemical analyses performed on the oil water separator, lithium bromide wastewater, and water discharges traced with lithium bromide; and the analytical results of semiannual sampling of drinking water from well J-13. In addition, an annual report summarizing all 2001 activities for this permit was submitted in January 2002 (Wade 2002e).

The underground injection control permit expired on January 26, 2001. A permit renewal application was submitted in 2000 (Wade 2000b) and was deemed complete by the Nevada Division of Environmental Protection. As provided in Nevada regulations, the YMP will continue to operate legally under the expired permit until a new permit is issued.

### **2.6.3 Nevada Statutes for Appropriation of Public Waters**

Use of groundwater in Nevada requires a permit from the Nevada State Engineer. The Nevada State Engineer reviews permit applications to determine whether or not there is available water at the source, the proposed use conflicts with existing water rights, or the proposed use threatens to prove detrimental to the public interest (NRS 533, Adjudication of Vested Water Rights: Appropriation of Public Waters).

The Nevada State Engineer issued temporary water appropriation permits to the DOE for two wells (J-12 and J-13) in March 1992. The permits were for the withdrawal of no more than 430 acre-ft per year (Turnipseed 1992a, 1992b, 1992c). About 42 acre-ft of water were pumped from those wells and put to beneficial use in 2001. These and subsequent water appropriation permits were subject to a stipulation that DOE conduct regional water-level monitoring. This program is described in Section 3.7.

A permanent water appropriation permit was issued to DOE in April 1992 for well VH-1 for approximately 61 acre-ft per year (Turnipseed 1992d). This amount is part of the total DOE appropriation limit of 430 acre-ft annually. During 2001, 556,000 gallons (about 1.7 acre-ft) of water were pumped from VH-1 and used for dust control and reclamation. A request to extend the period for proof of beneficial use of water from this well was filed in April 2001 and approved in January 2002, with the Extension of Time granted to April 9, 2002.

In June 1993 the Nevada State Engineer issued temporary water appropriation permits for three boreholes that comprise the C-Well Complex at Yucca Mountain (Turnipseed 1994a, 1994b, 1994c). During 2000, the Nevada State Engineer granted an extension for the three wells through April 9, 2002. No water was pumped from these wells in 2001.

The temporary permits for wells J-12, J-13, and the C-Well Complex expired in April 2002. On July 22, 1997, the YMSCO filed a water appropriation request with the Nevada State Engineer for permanent rights to 430 acre-ft annually in order to meet the DOE's responsibilities under the NWPA beyond April 2002. In February 2000, the Nevada State Engineer ruled against the DOE's water appropriation request on the grounds that the requested use is detrimental to the public interest of the citizens of Nevada. During 2001, legal appeals of the Nevada State Engineer's ruling were ongoing (see Section 2.9 for more information).

In April 2000, a one-year waiver was granted authorizing up to ten million gallons (about 31 acre-ft) of discharge from borehole NC-EWDP-19D. Under this waiver, 5,239,058 gallons (about 16 acre-ft) were pumped. Of this total, 1,236,419 gallons (about 4 acre-ft) were pumped and discharged to Fortymile Wash from January through April 2001. A two-year waiver was granted in April 2001 authorizing up to 120,000,000 gallons (about 370 acre-ft) of discharge from borehole NC-EWDP-19D. Under this waiver, a total of 299,808 gallons (about 1 acre-foot) were pumped during the remainder of 2001.

#### **2.6.4 EO 11988, Floodplain Management**

EO 11988 (42 FR 26951) requires that federal agencies develop regulations to evaluate the potential effects of their actions on flood hazards and floodplain management and avoid floodplain impacts to the extent practicable. The DOE has developed regulations to implement this EO (10 CFR 1022). These regulations require a public notice of all activities that are proposed within a floodplain, an evaluation of practical alternatives and design changes, a floodplain assessment, and a published statement of findings.

The DOE published a Notice of Floodplain/Wetlands Involvement for site characterization activities in 1989 (54 FR 6318). Two floodplain assessments for YMP activities at Yucca Mountain were then prepared (YMP 1991, 1992), and the associated statements of finding were published (56 FR 49765, 57 FR 48363). These actions meet the requirements of EO 11988 for all activities that occurred at Yucca Mountain during 2001.

In June 1999, the YMSCO published 64 FR 31554 (Floodplain and Wetlands Involvement: Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada) for activities associated with construction of a geologic repository at Yucca Mountain. A *Floodplain/Wetlands Assessment for the Proposed Yucca Mountain Geologic Repository* was included as Appendix J of the Draft EIS (DOE 1999). During 2001, comments received on the assessment were considered.

#### **2.6.5 EO 11990, Protection of Wetlands**

EO 11990 (42 FR 26961) requires federal agencies to develop regulations for considering wetlands protection during the decision-making process for their proposed actions. The DOE's regulations for implementing this EO are at 10 CFR 1022.

There are no wetlands at Yucca Mountain; therefore, the regulations in 10 CFR 1022 do not apply to site characterization activities conducted during 2001.

The DOE concluded in the *Floodplain/Wetlands Assessment for the Proposed Yucca Mountain Geologic Repository* (DOE 1999, Appendix J) that a wetlands assessment was not required for construction of a repository because there are no wetlands at Yucca Mountain. During 2001, comments received on the assessment were considered.

## **2.7 HAZARDOUS AND SOLID WASTES AND MATERIALS**

### **2.7.1 Federal Facility Compliance Act**

The Federal Facility Compliance Act amends portions of the Resource Conservation and Recovery Act (RCRA) to require compliance by federal facilities with federal, state, and local laws and regulations related to solid and hazardous wastes. In addition, the Federal Facility Compliance Act waives the federal government's sovereign immunity for violations of federal, state, and local laws and regulations related to solid and hazardous wastes. The YMP complies with all applicable laws and regulations related to solid and hazardous wastes, as described in Section 2.7.4.

### **2.7.2 Comprehensive Environmental Response, Compensation, and Liability Act and Associated Regulations**

The Comprehensive Environmental Response, Compensation, and Liability Act provides a framework for the cleanup of sites containing hazardous wastes that present a substantial danger to the public. As amended in 1986, it also requires emergency notification and response for release of a hazardous substance that exceeds threshold quantities. EO 12580, Superfund Implementation (52 FR 2923), delegates to heads of executive departments and agencies the responsibility for undertaking remedial actions for releases or threatened releases that are not on the National Priority List and removal actions other than emergencies where the release is from any facility under the jurisdiction or control of executive departments and agencies. If a reportable quantity of a hazardous substance were released into the environment, the DOE would immediately notify the National Response Center and the State of Nevada, and initiate clean-up activities. There were no releases in 2001 that exceeded reportable thresholds under either the Comprehensive Environmental Response, Compensation, and Liability Act or the State of Nevada requirements in NAC 445A.

### **2.7.3 Emergency Planning and Community Right-to-Know Act and Associated Regulations**

The Emergency Planning and Community Right-to-Know Act (EPCRA); NAC 477, State Fire Marshal; and NAC 459, Hazardous Materials, establish the planning, notification, permitting, and reporting requirements for hazardous substances and chemicals that are produced, used, stored, handled, transported, or released on the YMP.

Sections 302, 311, and 312 of the EPCRA require, among other things, that the owner or operator of a facility report quantities stored, and releases of, specified chemicals to the State Emergency Response Commission, Local Emergency Planning Committee, and local fire department with jurisdiction over a facility. Those sections also require that Material Safety Data Sheets be provided to those organizations. To meet those requirements, information on hazardous materials and chemicals at the YMP in 2001 (see Section 3.8) was reported in the *Nevada Combined Agency Hazmat Facility Report* (Wade 2002f), which is prepared annually in accordance with NAC 477 and submitted to the Nevada Office of the State Fire Marshal, Nevada State Emergency Response Commission, Nye County Local Emergency Planning Committee,

and local fire protection services. That report also serves as the application for renewal of the Nevada hazardous materials storage permit.

EPCRA Section 304 requires the owner of a facility that produces, uses, or stores a hazardous chemical to immediately notify the State Emergency Response Commission and Local Emergency Planning Committee of a release of specified hazardous substances that is not federally permitted, exceeds the reportable quantity, and results in exposure to persons offsite. There were no releases of specified hazardous substances during 2001.

Section 313 of EPCRA requires certain owners or operators of facilities that manufacture, process, or otherwise use listed toxic chemicals in excess of established thresholds to submit annual reports on the amounts of those chemicals released into the environment. The YMP did not manufacture, process, or otherwise use any chemicals regulated under Section 313 of EPCRA in excess of threshold quantities.

NAC 459 requires facility owners and operators that produce, use, store, or handle highly hazardous substances in amounts that equal or exceed threshold quantities to register with the Nevada Division of Environmental Protection and develop a management system for these substances. In 2001, the YMP did not meet or exceed any threshold quantities for highly hazardous substances and was not required to register.

#### **2.7.4 Resource Conservation and Recovery Act and Associated Regulations**

The RCRA is a comprehensive program for regulating and managing hazardous wastes (Subtitle C), non-hazardous solid wastes (Subtitle D), and underground storage tanks (Subtitle I), and promoting the use of recycled and recovered materials (Subtitle F). RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. RCRA sets a federal policy of restricting land disposal of untreated hazardous wastes in favor of environmentally preferred alternatives such as treatment, source reductions, and recycling. Regulations promulgated under RCRA define hazardous wastes and specify requirements for their transport, handling, treatment, storage, and disposal. Section 6001 of RCRA requires federal agencies to comply with all federal, state, interstate, and local requirements relating to the control and abatement of solid and hazardous waste disposal.

**Subtitle C**—In 1985, the EPA authorized Nevada to administer Subtitle C of RCRA (managing hazardous waste). The Nevada Division of Environmental Protection is the agency responsible for administering this part of RCRA (NAC 444, Sanitation). Activities at the Yucca Mountain site generate more than 100 kilograms (kg) (220 pounds [lbs]) but less than 1,000 kg (2,204 lbs) per month of RCRA-defined hazardous wastes and therefore, the site is regulated under the act as a small-quantity generator. The YMP submitted a "Notification of Hazardous Waste Activity" to the Nevada Division of Environmental Protection for the generation of hazardous waste at the Yucca Mountain site in 1989 and received EPA identification number NV7890090023. Activities at the YMP's Las Vegas office facilities generate less than 100 kg (220 lbs) per month of RCRA-defined hazardous wastes and therefore, the site is regulated under the act as a conditionally exempt small quantity generator.

State of Nevada regulations also require small quantity generators to complete a biennial hazardous waste report. The report identifies the types and quantities of hazardous waste generated and transported offsite for treatment, storage, or disposal by the YMP and is used to track national trends in waste management practices. A biennial hazardous waste report was submitted to the Nevada Division of Environmental Protection in February 2002 for the Yucca Mountain site (Wade 2002g).

**Subtitle D**—Non-hazardous solid waste is regulated by Nevada pursuant to Subtitle D of RCRA (NAC 444). Refuse, along with salvageable, industrial, and special non-hazardous waste, were recycled or disposed of during 2001 in accordance with these regulations (Section 3.8.2).

**Subtitle F**—Subtitle F of RCRA requires that federal agencies comply with all federal, state, interstate, and local requirements stemming from RCRA, unless exempted by the President. The YMP complies with the requirements of RCRA as described above. Subtitle F also encourages the federal government to institute a procurement policy that encourages the purchase of recoverable materials, which, because of their performance, can be substituted for virgin material at a reasonable price. YMP compliance with the procurement policy is discussed in Section 3.8.3.

**Subtitle I**—The management of the RCRA underground storage tank program has been delegated to Nevada (NAC 459). Because YMP activities do not require the use of underground storage tanks regulated by Subtitle I, this section is not applicable.

### **2.7.5 Toxic Substances Control Act**

The Toxic Substances Control Act authorizes the EPA to require testing of new chemical substances that enter the environment and to regulate those chemicals when necessary. This act complements and expands existing toxic substance laws such as Section 112 of the Clean Air Act and Section 307 of the Clean Water Act. This act also regulates certain toxic substances, specifically polychlorinated biphenyls, chlorofluorocarbons, asbestos, dioxins, certain metal-working fluids, and hexavalent chromium. In 2001, there were no YMP activities subject to this act.

### **2.7.6 Federal Insecticide, Fungicide, and Rodenticide Act**

The Federal Insecticide, Fungicide, and Rodenticide Act requires that all pesticides used in the U.S. be submitted for registration by the EPA. To be approved for registration, pesticides must meet criteria regarding the quantity, quality, and impact upon the environment by the active ingredient(s). No manufacturer or importer may make or sell a product for use to control pests unless the compound is registered with the EPA. Pesticide applications for the YMP are performed by licensed contractors, who are required to be in full compliance with all local, state, and federal rules and regulations, including those in the Federal Insecticide, Fungicide, and Rodenticide Act.

## **2.8 DOE POLICIES AND ORDERS**

The following DOE Policies and Orders were directly applicable to the environmental programs conducted by the YMSCO during 2001.



DOE Policy 450.4, *Safety Management System Policy*, describes objectives, guiding principles, and core functions of an ISMS to be implemented throughout the DOE complex. DOE acquisition regulations (48 CFR 970) require contractors to manage and perform work in accordance with a documented ISMS. BSC documents its processes and mechanisms for implementing ISMS in an Integrated Safety Management Description Document (Description Document) that is updated annually and submitted to DOE per contractual requirement. An update of the Description Document was submitted to the YMSCO in September 2001 (Anderson 2001). That document describes the successful implementation of ISMS objectives throughout BSC operations and includes the results of a review conducted in 2001 by BSC senior managers and DOE representatives to evaluate BSC compliance with these objectives. DOE accepted the updated Description Document to indicate approval of BSC's ISMS program implementation.

DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, is the DOE policy for line management environment, safety and health (ES&H) oversight and for the use of contractor self-assessment programs to implement that oversight. Section 3.9 describes the YMP environmental assessment program.

DOE Order 231.1, *Environmental, Safety, and Health Reporting*, establishes requirements to ensure that ES&H information required by law or regulation, or essential for evaluating operations and identifying opportunities for improvements, is collected and reported. This Site Environmental Report and an annual NEPA planning summary (see Section 2.1.2) are the reporting requirements of this Order applicable to the YMP environmental program.

DOE Order 451.1, *National Environmental Policy Act Compliance Program*, describes DOE's requirements and responsibilities for implementing the requirements of NEPA, the Council on Environmental Quality Regulations Implementing the Procedural Provisions of NEPA (40 CFR 1500), and the DOE NEPA Implementing Procedures (10 CFR 1021). Section 2.1.2 includes a summary of actions taken by the YMSCO to comply with NEPA and this order.

DOE Order 5400.1, *General Environmental Protection Program*, establishes environmental protection program requirements, authorities, and responsibilities for DOE operations to ensure compliance with applicable federal, state, and local environmental protection laws and regulations, EOs, and DOE policies. This order more specifically defines the environmental protection requirements that are generally established in DOE Order 5480.4. DOE Order 5400.1 also requires environmental monitoring programs. The comprehensive environmental program described in this Site Environmental Report implements the requirements of DOE Order 5400.1.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, establishes limits and requirements for a variety of scenarios involving potential exposure to radiation. Also covered are the radiological monitoring requirements for the sale or release of potentially radiologically contaminated equipment or material to the general public. Project equipment scheduled to be released to the general public are surveyed in accordance with this Order. The Project does not release any item having levels of residual radioactive contamination greater than those listed in this Order; therefore, the requirement in the Site Environmental Report guidelines (Lawrence 2002) to discuss approved release limits, dose estimates, radionuclide concentrations, and expected end-use scenarios are not applicable..

DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards*, specifies requirements for mandatory ES&H standards applicable to all DOE and DOE-contractor operations, lists reference ES&H standards, and identifies the sources of the mandatory environmental standards. The mandatory standards listed in this Order that were applicable to the YMP during 2001 are the laws and regulations described in this section.

DOE Notice 450.4, *Assignment of Responsibilities for Executive Order 13148, Greening the Government Through Leadership in Environmental Management*, assigns responsibilities for implementing EO 13148. See Section 2.1.4 for details about the implementation of this Notice.

## **2.9 PERMIT ASSOCIATED LITIGATION**

On February 2, 2000, the Nevada State Engineer denied DOE's water appropriation request for 430 acre-ft per year for use at Yucca Mountain based on a finding that the requested use threatened to prove detrimental to the public interest (Turnipseed 2000). DOE filed suits on March 2, 2000, in the U.S. District Court for the District of Nevada, and on March 3, 2000, in Nevada's Fifth Judicial District Court, for injunctive relief to overturn the Nevada State Engineer's ruling.

On September 21, 2000, a U.S. District Court Judge granted the State's motions to dismiss the DOE lawsuit. DOE appealed this ruling on November 16, 2000. On October 15, 2001, the Ninth U.S. Circuit Court of Appeals ordered a federal judge to hear the DOE's suit. The case is pending.

## **3. ENVIRONMENTAL PROGRAMS**

This section describes the environmental program conducted during 2001 to implement the requirements of environmental permits described in Section 2, monitor impacts of the Project, and protect the environment at Yucca Mountain. The organization, responsibilities, and requirements of this program are described in greater detail in the *Environmental Management Plan* (YMP 2000b).

All aspects of this environmental program are conducted in accordance with the YMP ISMS. During the planning stage of all Project activities, potential hazards to the environment are identified, and measures to mitigate those hazards, including pollution prevention and environmental protection practices, are developed. These mitigation measures, as well as clear roles and responsibilities for conducting work and ensuring compliance, along with environmental training, are incorporated into written procedures (i.e., work instructions) that describe how the work must be conducted. For maintenance and other ongoing projects, this environmental review is conducted during planning and development of work instructions. For new activities at Yucca Mountain, a review also occurs as part of the land access review and control process (Section 3.1). Assessments (Section 3.9) and surveillances (Section 3.10) are conducted to ensure that work is performed within controls and to provide feedback for improvement.

### 3.1 LAND ACCESS REVIEW AND CONTROL

All new YMP activities and all ongoing activities that are substantially modified or require access to additional land must undergo a review prior to implementation. This process is initiated when principal investigators or responsible managers submit a land access request. The request is evaluated to determine whether the activity (1) is covered under existing ROWRs; (2) will result in land use conflicts; (3) will be in compliance with applicable federal, state, and local environmental laws and regulations (YMP 2001a, Section 7); (4) will require any new regulated, hazardous materials; and (5) will require additional environmental permits or modifications to existing permits. If new permits are required, they are obtained at this time. Reviews or preactivity surveys for biological and cultural resources (Sections 3.2 and 3.4) are conducted to evaluate potential impacts to those resources and prepare for future reclamation. Surveys for radiological hazards and residual radiological contamination also are conducted for activities to occur on parts of the NTS.

If the activity can be conducted in compliance with environmental regulations and is acceptable to the YMSCO, a land access approval letter is issued. That letter contains permit requirements and other stipulations that must be incorporated into planning and implementation procedures as part of the YMP ISMS.

If necessary, clearance surveys for tortoises are conducted shortly before ground-disturbing activities are to begin (Section 3.2). If available, topsoil is then removed and stored onsite or at one of the Project's existing topsoil stockpiles. During activities, surveillances are conducted to evaluate compliance with environmental stipulations (Section 3.10). After activities have been completed, the amount of land disturbed is measured to track compliance with the biological opinion for the YMP (Buchanan 1997). If the site is no longer to be used, a reclamation plan is developed (Section 3.3).

During 2001, nine requests for land access were received by the YMSCO. Complete or partial approval was granted for eight of the activities, including five scientific studies, one construction project, and two plans for reclaiming disturbed sites. The ninth activity was placed on hold until 2003 due to budget constraints. Five of the approved activities and one partially approved activity occurred or will occur on areas covered by existing ROWRs. One activity occurred within an area covered by a ROWR granted by the BLM to Nye County. Permission from the BLM for access to sites in Amargosa Valley was obtained in 2002 for completion of the partially approved activity. The other activity was for removal of a seismic station from an area in California that was classified as wilderness after establishment of the station.

Five of the activities required biological or archeological reviews or surveys, and one of those activities required reclamation inventories. The other three activities occurred or will occur within existing disturbed areas and therefore did not require those reviews or surveys.

Permit approvals were required for three of the activities. The construction activity required consultation with the Nevada Division of Health, which oversees the YMP public water system permit. Two of the scientific testing activities required new approvals under the underground injection control permit.

No removal of vegetation, scraping of topsoil, or other permanent habitat disturbances occurred during 2001. Therefore, the total amount of land disturbed by site characterization activities since 1991 remained at 128.8 ha (318.3 acres). This is 39.2 ha (96.7 acres) less than the limit of 168 ha (414 acres) stipulated in the biological opinion for the YMP (Buchanan 1997). Of the 128.8 ha (318.3 acres) disturbed by site characterization, 109.6 ha (270.8 acres) were disturbed prior to 1996. The amount of land disturbed per year has decreased over the past few years, with 6.1, 5.0, 2.4, 0.8, and 0.0 ha (15.1, 12.4, 5.9, 2.0, and 0.0 acres) disturbed from 1997 through 2001, respectively.

### **3.2 BIOLOGICAL SURVEYS**

Biological surveys are conducted to comply with the Endangered Species Act, Migratory Bird Treaty Act, and Section 404 of the Clean Water Act and to develop methods for minimizing the impacts of YMP activities on plants and animals.

The biological opinion for the YMP (Buchanan 1997) requires preactivity surveys for desert tortoises prior to clearing of vegetation. During those surveys, biologists evaluate potential impacts to tortoises from the proposed activity and, if necessary, identify ways to modify the activity to avoid harming tortoises and their burrows. Project biologists also evaluate potential impacts to migratory birds and other plant and animal species classified as sensitive by the BLM (or other involved land management agencies). In addition, biologists determine whether activities will need a permit to place dredged or fill material into waters of the U.S.

Five land access requests were reviewed in 2001 to identify potential impacts to biological resources or to develop reclamation stipulations. One activity, installation of suction lysimeters in two washes at Yucca Mountain by the State of Nevada, required a preactivity survey. No desert tortoises were found and no potential impacts to migratory birds were identified during that survey. One of the washes could be a water of the U.S. and installation of the lysimeter was covered by Nationwide Permit 5, *Scientific Measurement Devices*, issued by the U.S. Army Corps of Engineers in 1996 (61 FR 65874). Much less than 10 cubic yards of fill material was placed in this wash; therefore, notification of the Corps was not required under this permit.

The biological opinion for the YMP (Buchanan 1997) also requires clearance surveys to move tortoises or tortoise nests if they are in danger. Those surveys must be conducted before ground-disturbing activities, off-road driving, or filling of trenches can commence. During 2001, two clearance surveys were conducted for the near surface velocity structure investigations (one for each of two seismic routes), and 13 surveys were conducted for sites to be reclaimed. No tortoises were found during those surveys.

### **3.3 HABITAT RECLAMATION**

Habitat reclamation is conducted to comply with the terms and conditions of the biological opinion for site characterization (Buchanan 1997); meet requirements in the Project's ROWRs (e.g., BLM 1988, 1994); implement requirements in the Project's air quality operating permit (Elges 2001) to reclaim sites to minimize soil erosion and windblown dust; reduce the spread of exotic plant species as required by EO 13112; implement commitments in the Environmental

Assessment for site characterization (DOE 1986, Sections 4.1.1.4 and 4.1.2.6); and minimize impacts of site characterization, as required by Section 113 of the NWPA.

Reclamation is conducted in accordance with the *Reclamation Implementation Plan*, which was updated in 2000–2001 (YMP 2001b). The long term goal of this program is to re-establish processes on disturbed sites that will eventually lead to the establishment of self-sustaining plant communities. Planning inventories, reclamation surveys, implementation, monitoring, remediation, and site release evaluations are conducted to accomplish this goal. The planning process includes pre- and post-disturbance surveys and evaluations of past reclamation trials at Yucca Mountain. This information is used to identify appropriate implementation techniques for establishing structural and physical components, controlling soil erosion, and facilitating establishment of native vegetation. After implementation, monitoring is conducted to evaluate plant growth, identify remediation needs, and make final determinations regarding reclamation success so that sites may be released from further input by DOE.

### **3.3.1. Reclamation Inventories**

Reclamation inventories are conducted as part of land access reviews to identify methods for reducing the impact of construction activities and to assess site conditions and resources for final reclamation. Vegetation associations, plant species and their abundance, and the presence of exotic species are measured during these inventories. Stipulations may be developed for depth and location of topsoil stockpiles, chemical or vegetative stabilization of stockpiles, plant salvage, and practices to reduce wind or water erosion. Stipulations from the inventories are incorporated into approval letters for land access.

During 2001, reclamation inventories were conducted prior to the installation of suction lysimeters in two washes. Because the proposed disturbances were minimal, there were no requirements for stockpiling topsoil.

### **3.3.2 Reclamation Surveys**

Reclamation surveys are conducted to assess reclamation requirements at disturbed areas that are no longer needed for the YMP. During these surveys, information is gathered on slope, aspect, disturbance area, disturbance severity, site preparation needs for revegetation, and intensity of reclamation required. Based on this information, a final reclamation plan is written. This plan details the actions needed for site preparation and reclamation implementation. Prior to any reclamation, site decommissioning is completed, including removing waste and aboveground man-made structures, filling trenches, and closing and sealing boreholes.

Five reclamation surveys were conducted in 2001 for sites that are being considered for closure. Surveys were conducted for an analog seismic station (PPK), two large borrow areas (Subdock BP and H-1 BP), a trench near the Yucca Mountain Crest Access Road (USW UZN-66 TR), and a large scraped area at the north end of Yucca Mountain (Site 1). It was concluded that all sites will require reclamation.

Reclamation plans were written for Site 1, USW UZN-66 TR, and PPK. Recontouring, ripping, seeding, and mulching were recommended for Site 1 and USW UZN-66 TR. Site 1 also required addition of topsoil to establish a seedbed and provide a growth medium for plants. Seed-bed

preparation and erosion control were recommended at PPK. Final reclamation plans for the borrow areas will be written in 2002, and reclamation will occur in 2002 or 2003.

### **3.3.3 Reclamation Implementation**

Short-term reclamation is implemented when topsoil removed from disturbed sites is to be stockpiled for less than one year, and for trenches or pits that are backfilled outside of the usual planting window (October through December). Chemical stabilization of the surface soil is commonly used in these circumstances. No short-term reclamation was required in 2001.

Final reclamation is implemented on long-term topsoil stockpiles and on sites that are no longer needed for the YMP and have been decommissioned. Final reclamation generally includes spreading and contouring topsoil, creating erosion-control structures, ripping, seeding, spreading and anchoring mulch, and fencing to exclude grazers.

Final reclamation was completed at 13 sites in 2001. These included seven analog seismic stations (EPR, MTI, SRG, WRN, YMT1, YMT2, and YMT3), three waste handling building test pits (TP-WHB-2, 3, and 4), one pre-1991 trench (USW UZN-66 TR), two borrow pits (Castle Point and South Yucca Mountain), and Site 1. These sites totaled 4.87 ha (12.03 acres). Sites were seeded in January or November–December with a mixture of native plant species. After seeding, all sites except the seismic stations were mulched with straw, which was anchored to the soil with a chemical tackifier. All seismic stations except YMT1 were seeded and raked to cover the seed. Seeding was not required at seismic station YMT1; however, a sign was placed across the access road to discourage travel.

Six of the reclaimed sites are on BLM land controlled through ROWRs: seismic stations MTI, SRG, WRN, and YMT2; the South Yucca Mountain borrow pit; and USW UZN-66 TR. YMT1 and the Castle Point borrow pit are on the ROWR for Nellis U.S. Air Force Range. EPR is on the Desert National Wildlife Refuge. The remaining four sites are on the NTS.

### **3.3.4 Reclamation Monitoring and Remediation**

Success standards were developed to assess the condition of vegetation on reclaimed sites and to determine when sites can be released from further monitoring. These standards are set forth in the *Reclamation Implementation Plan* (YMP 2001b, Section 6.1). The plan establishes that reclamation can be considered successful, and sites can be released from monitoring if cover, density, and species richness of native perennial vegetation are equal to, or exceed, 60 percent of the values of the same parameters in undisturbed reference areas.

Sites are qualitatively monitored periodically to determine whether they are progressing towards the reclamation standard and ultimately toward the long-term goal of a self-sustaining plant community. If progress is not satisfactory, remediation (e.g., re-seeding, transplanting, erosion control efforts) is conducted. Qualitative methods also are used to assess whether release conditions are met on small sites (<0.10 ha). Quantitative monitoring is done at large sites (>0.10 ha) to compare vegetative conditions to the success standards.

During the summer of 2001, 127 reclaimed sites, including soil pits, trenches, boreholes, exposures, support activities, and access roads, were monitored qualitatively. Forty-five percent

of the sites were in good condition, 44 percent were in fair condition, 5 percent were in failing condition, and 6 percent were not assigned a rating because plant density was too low. Germination on unrated sites was probably poor because of dry soil conditions; germination is expected when soil conditions become more favorable. Sites in failing condition were generally those that had been reclaimed the previous winter, and germination had not yet occurred.

During 2001, 1,172 plants of seven species were transplanted onto 24 sites to increase plant density, cover, and diversity. Transplanted species included *Achnatherum speciosa*, *Ambrosia dumosa*, *Encelia virginensis*, *Menodora spincens*, *Larrea tridentata*, *Lycium andersonii*, and, *Salazaria mexicana*. These species were selected because they did not establish very well from seed or seed was not available commercially. During 2001, seeds were provided to the Nevada State Tree Nursery to begin growing transplants for 2002.

Remediation was conducted on two access roads in Crater Flat. The roads were reclaimed in the fall of 1996 but were in poor condition because of heavy compaction along the tire tracks. These access roads were re-ripped along the tire tracks, re-seeded, and harrowed to cover the seed. Approximately 0.5680 ha (1.40 acre) were remediated.

Vegetation cover and soil erosion were monitored on 39 topsoil stockpiles. No action was required to maintain these stockpiles. Soil from these stockpiles will be respread over sites during final reclamation.

A report was drafted in 2001 (and completed in 2002) that summarized annual monitoring of 31 small sites reclaimed in 1993 and 1994 and evaluated for release in 2000 (Rasmuson 2002). Recommendations were made for release of 29 sites. Because of low plant density and cover on the remaining two sites (UE-25 GSF-TP #19 and #20), recommendations were made for further remediation. Transplants were added to these two sites in late spring 2001.

One large site, a 1.5-ha (3.7-acre) leachfield pipeline, was evaluated for release in 2001. Plant density, cover, and species richness met the 60 percent guideline and the site will be recommended for release.

### **3.4 CULTURAL RESOURCES AND NATIVE AMERICAN INTERACTIONS**

Surveys for archeological resources, educational initiatives, and interactions with Native Americans were conducted to comply with the Programmatic Agreement (DOE 1988b) and to meet the requirements of the laws and regulations described in Section 2.6.

#### **3.4.1 Survey, Data Recovery, and Research**

The Programmatic Agreement requires the YMP to conduct preactivity surveys for cultural resources before sites are disturbed. It also requires that survey activities, findings, and related data-recovery efforts be reported to various state and federal agencies. In addition, the condition of known archaeological sites must be monitored periodically, and research must be conducted in accordance with the *Research Design and Data Recovery Plan for Yucca Mountain Project* (DOE 1990). Artifact inventories are submitted to the U.S. Department of the Interior in compliance with reporting requirements of the Native American Graves Protection and

Repatriation Act. Artifacts are maintained in a storage facility in Las Vegas, Nevada, in accordance with 36 CFR 79 and stipulations of the Programmatic Agreement.

Six archaeological preactivity surveys (for five land access requests) were conducted during 2001 in areas proposed for site characterization activities. Archaeological surveys were also conducted at four sites to be reclaimed. One new archaeological site and five isolated artifacts were identified during those surveys. Three survey and monitoring reports were submitted to the SHPO and Advisory Council on Historic Preservation. One reconnaissance report on cultural resources was submitted to the BLM. Conditions at three previously documented historical properties at Yucca Mountain were evaluated; no changes were observed at those sites. No mitigative data-recovery plans were developed and no new artifacts were collected during 2001.

Several studies were conducted to answer research questions identified in the *Research Design and Data Recovery Plan for Yucca Mountain Project* (DOE 1990). Studies included the continued development of a chronology and settlement classification of surface archaeological sites; analyses of various artifact classes including stone tools, ceramics, and historical materials; and updating and quality-correcting databases.

### **3.4.2 Educational Initiatives**

The Project has developed educational displays to inform YMP workers and the public about the YMP archaeological program and the kinds of historical properties at the site. Items displayed include maps of southern Nevada depicting areas historically occupied by various tribes; biographical sketches of local Native Americans; projectiles and written explanations of their manufacture; examples of basket weaving and animal traps; traditional stories relating to certain plants and animals; and descriptions of plants as religious objects and sources of food, clothing, and medicine. These displays are located at the Yucca Mountain Science Centers in Las Vegas, Beatty, and Pahrump, and at the ESF for use during public tours. A portable display and slide show has been developed for other presentations.

### **3.4.3 Native American Interactions**

The YMSCO continued consultations and interactions with involved Native American tribes in 2001, as directed by the laws and regulations summarized in Section 2.4. Currently, the YMP Native American Interaction Program involves 17 concerned tribes and organizations (comprised of Western Shoshone, Southern Paiute, and Owens Valley Paiute and Shoshone) located in Nevada, California, Utah, and Arizona.

The YMP sponsored a Tribal Update Meeting in June primarily to discuss the Supplement to the Draft EIS (DOE 2001c). DOE presented information on the Supplement to Official Tribal Contact Representatives, and a court reporter recorded comments of tribal representatives. The meeting included presentations on site characterization studies, changes to repository surface and subsurface design, and YMP archaeological studies.

A second Tribal Update Meeting was held in October. The meeting focused primarily on discussions related to the *Yucca Mountain Preliminary Site Suitability Evaluation* (DOE 2001b) and the site recommendation process. After the information was presented, a question and answer session followed. A court reporter recorded statements, recommendations, and concerns



from tribal representatives, which was considered as part of the site recommendation process. Discussions were also held concerning the YMP's application to renew the public land order that prohibits mineral/mining claims on a portion of BLM land on Yucca Mountain. Meeting attendees also discussed the development of a new Programmatic Agreement to replace the current agreement, which expired when a formal site recommendation was made by the President.

Also during 2001, the YMP sponsored attendance of DOE, contractors, and Native American representatives at meetings or training sessions, including the annual meeting of the National Congress of American Indians. A staff member attended meetings of the Transportation External Coordination Working Group in Portland, Oregon, and Cincinnati, Ohio, where issues associated with transportation of spent nuclear fuel and high-level radioactive waste were discussed. A staff member also attended the DOE Tribal Transportation Resource Meeting in Albuquerque, New Mexico. In addition, the DOE sponsored educational workshops, speaking engagements, and site tours at which the YMP Native American program was explained to the public.

In response to a tribal request, Project personnel met with the Timbisha Shoshone Tribe in Death Valley, California, during June for official discussions on the Supplement to the Draft EIS (DOE 2001c), the status of the program, and the site recommendation process. In December, Project staff visited the Paiute Indians Tribes of Utah in Cedar City, Utah, for official discussions on the site recommendation process.

The YMSCO has a standing offer to continue consultations required by the Native American Graves Protection and Repatriation Act with any tribe that was not able to participate during the 1998/1999 consultation process. To date, the DOE has received no additional consultation requests or formal requests for repatriation of artifacts meeting the criteria of that act.

No data-recovery efforts were conducted during 2001. Consequently, the Native American monitor program, in which Native Americans accompany archaeological staff in the field to ensure Native American sensitivities are considered during artifact collection, was not used during the year.

### **3.5 AIR QUALITY**

Ambient air-particulate matter has been sampled as part of the environmental monitoring program since 1989 using standard regulatory agency methods. From 1991 to 1999, the State of Nevada air quality operating permit for the YMP stipulated that DOE must measure  $PM_{10}$  at Yucca Mountain. Monitoring has continued since then to demonstrate continued compliance with federal (40 CFR 50) and Nevada (NAC 445B) ambient air quality standards.

Air quality was monitored at three sites during 2001. Site 1 is in Midway Valley near the ESF (Figure 3). Site 5 is in Jackass Flats along Fortymile Wash and was selected to measure remote, background concentrations near a dirt road. Site 9 is at Gate 510 on the NTS near Amargosa Valley, about 20.9 km (13 miles) south of the ESF. This site, located on the southern boundary of the NTS near the community of Amargosa Valley, is used as an indicator of "ambient" air quality. Two  $PM_{10}$  samplers were operated simultaneously at Site 1 to assess the precision of

measurements for quality assurance (QA) requirements.  $PM_{10}$  has been sampled at Sites 1 and 5 since April 1989, and at Site 9 since October 1992.

Twenty-four-hour sampling was scheduled every sixth day during 2001, as in previous years. Sites 1, 5, and 9 had valid sampling results for 61, 60, and 61 days, respectively, out of 61 possible scheduled days. The sampling and analysis program was performed in accordance with EPA and Nevada standards, monitoring requirements, and guidance.

Concentrations of airborne particulate matter were very low in 2001 (Table 2). The highest 24-hour concentration of  $PM_{10}$  in 2001 was 27 micrograms per standard cubic meter ( $\mu g/m^3$ ) (the highest ever recorded at Yucca Mountain was 67  $\mu g/m^3$  in 1995). All measurements in 2001 were much lower than the maximum allowable 24-hour concentration of 150  $\mu g/m^3$ . Arithmetic mean concentrations were 10  $\mu g/m^3$  or less, which are about 80 percent lower than the maximum allowable annual arithmetic mean of 50  $\mu g/m^3$ . These concentrations are similar to those from previous years (Table 2).

### 3.6 METEOROLOGICAL MONITORING

Local meteorology has been monitored at Yucca Mountain since 1986 to characterize environmental conditions, study mechanisms of airborne transport of contaminated materials, and provide input to the design of surface facilities.

Meteorological parameters, including wind, temperature, humidity, precipitation, barometric pressure, and atmospheric stability, were measured at four sites during 2001 (Sites 1, 2, 4, and 9) (Figure 3). Precipitation, air temperature, and humidity were measured at five other sites (Sites 3, 5, 6, 7, 8) around Midway Valley and in Jackass Flats. Rain and snow also were measured at three all-season precipitation gauges (Sites 401, 405, and 415) on the crest of Yucca Mountain.

Precipitation during 2001 was about 10 percent below the 5-year average and was about 50 percent less than the very wet year of 1998 (Table 3). Precipitation varied considerably among sites, with Site 9 in Amargosa Valley having the least amount each year, and Sites 3 and 6 on the east and north sides of Yucca Mountain generally having the most.

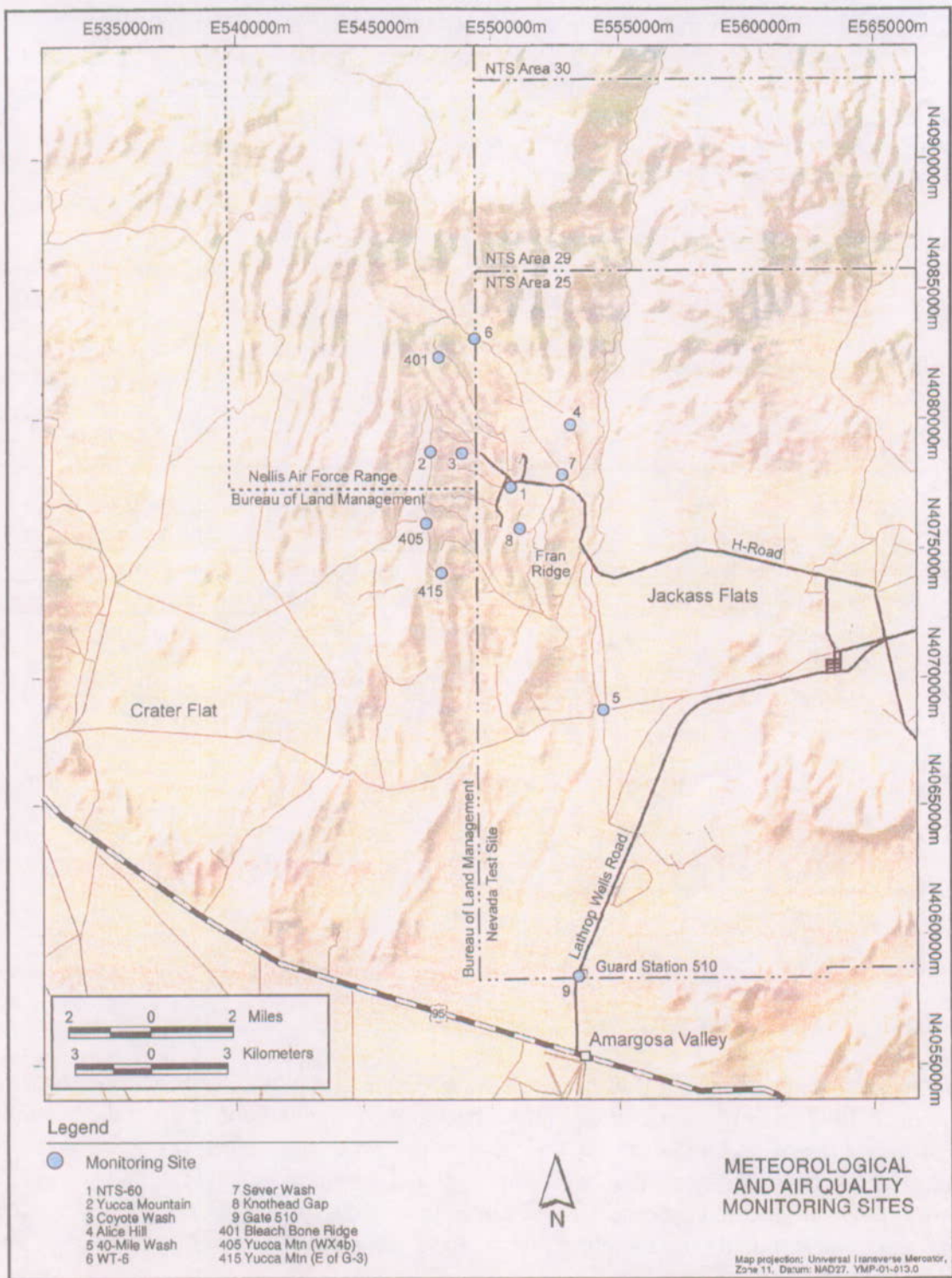


Figure 3. Air Quality and Meteorology-Monitoring Sites

Table 2. Summary of Ambient Particulate Matter PM<sub>10</sub> Sampling, 1997-2001 (µg/m<sup>3</sup>)

Site	1997	1998	1999	2000	2001
Highest 24-hour average					
1	31	30	18	38	23
5	26	26	24	45	27
9	29	22	18	36	22
Second-highest 24-hour average					
1	21	17	34	34	19
5	19	18	21	39	25
9	19	20	17	33	19
Arithmetic mean of 24-hour average					
1	8	8	8	11	8
5	9	7	8	12	10
9	8	6	8	11	9

Table 3. Annual Precipitation at Meteorological Sites, 1997-2001

Site	Elevation (m)	Precipitation (cm)					Average
		1997	1998	1999	2000	2001	
1	1,143	14.1	36.7	18.3	24.6	18.0	22.3
2	1,478	13.5	35.0	14.5	22.2	19.9	21.0
3	1,279	14.5	41.5	18.2	26.1	21.9	24.4
4	1,234	14.3	34.5	20.8	21.9	18.6	22.0
5	953	12.9	29.7	8.6	13.6	12.8	15.5
6	1,315	16.5	44.2	13.4	27.2	22.4	24.7
7	1,081	14.8	35.4	20.1	25.2	17.1	22.5
8	1,131	13.8	34.1	16.0	24.7	17.4	21.2
9	838	9.6	22.5	6.6	10.4	11.5	12.1
401	1,562			12.2	24.5	20.6	19.1
405	1,488			16.1	21.1	15.1	17.4
415	1,440			14.3	18.7	15.9	16.3

### 3.7 WATER MONITORING

Groundwater levels and spring flows in the Yucca Mountain region have been monitored for the YMP since 1992 to (1) detect and document background fluctuations in regional groundwater levels, spring flows, and withdrawals, and (2) identify potential effects, if any, of groundwater withdrawals from YMP-permitted wells on regional groundwater levels and spring flows. Because the YMP does not release effluents into groundwater or otherwise affect the quality of that water, water quality is monitored only to meet permit requirements as described in Section 2.6.

During 2001, groundwater levels and spring flows were monitored at 34 wells, 1 flowing well, and 5 springs (Figure 4). Water levels generally were measured monthly at wells, and discharge rates at springs were measured quarterly. Annual estimates of groundwater withdrawals were obtained primarily from the DOE, U.S. Geological Survey, and Nevada Division of Water



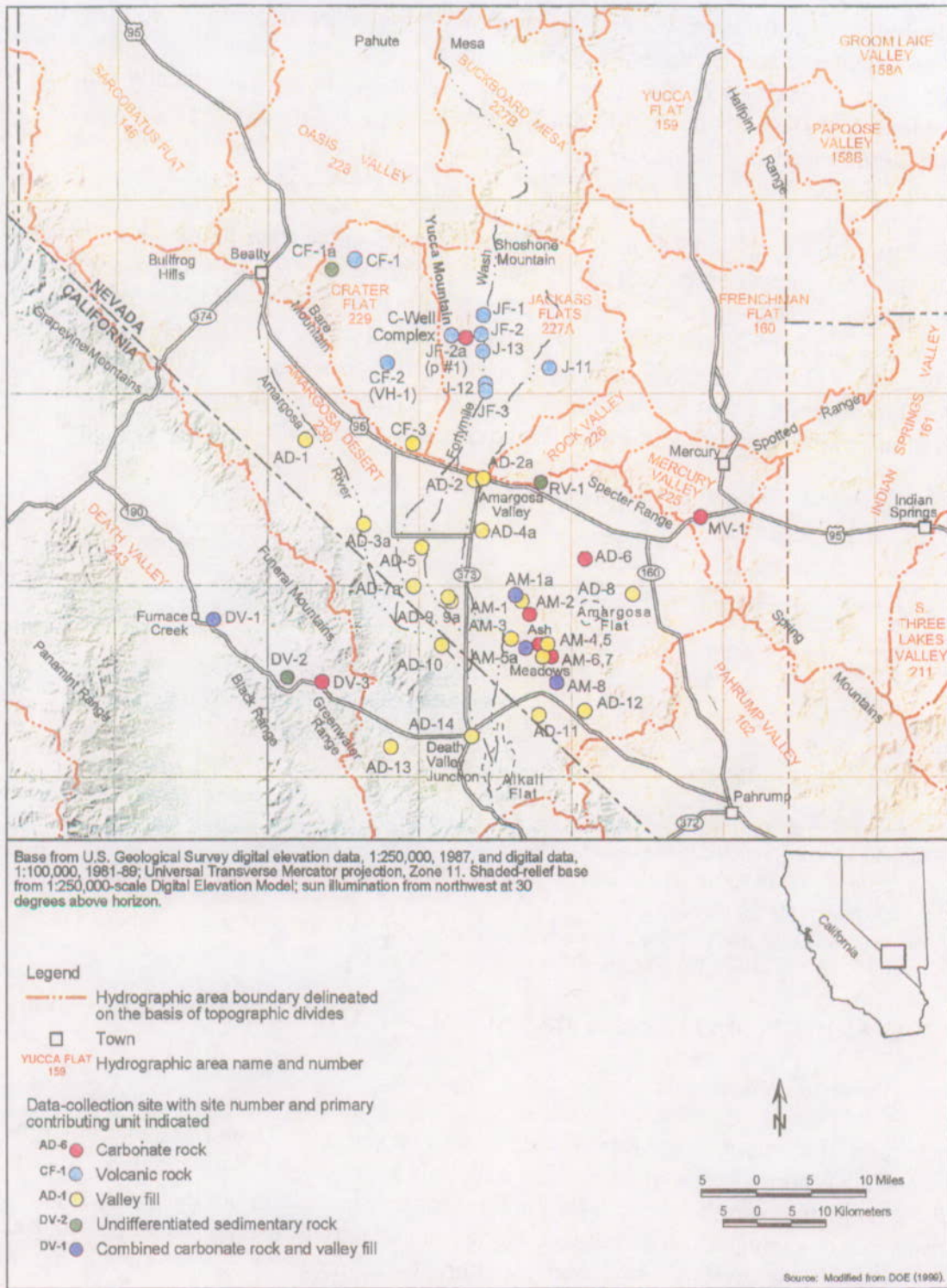


Figure 4. Groundwater Monitoring Wells and Springs

Resources. Quarterly reports summarizing groundwater levels and discharge rates were submitted to the Nevada State Engineer, Southern Nevada Water Authority, U.S. Fish and Wildlife Service, State of Nevada Nuclear Waste Project Office, and National Park Service.

The potential effects of water withdrawals from YMP wells are assessed by comparing current data to historical or baseline water levels and spring flows. Additionally, the spring discharge measurements provide data on the status of water availability in environmentally sensitive areas of Ash Meadows, Devils Hole, and Death Valley. Results of this monitoring program through 1999 are summarized in *Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1999* (Locke 2001).

Well JF-3 was installed in 1992 and routinely measured since then to monitor the effects of groundwater withdrawals from wells J-12 and J-13 (Figure 4). The depth to water in this and most other YMP monitoring and water supply wells in Basin 227A (J-11, J-12, J-13, JF-1, and JF-2) was almost identical to baseline water levels (Table 4). The water level in monitoring well JF-2a was about 2.4 feet higher than the pre-1991 baseline water level (Table 4). JF-2a was completed in the confined carbonate aquifer (Section 1.1.3). This rise in the water level has been attributed to upward flow from the carbonate aquifer (Luckey et. al. 1996, pp. 40 and 41).

Table 4. Water Level Altitudes (ft) at Wells in Jackass Flats<sup>a</sup>

Well	n	2001 <sup>b</sup>			Previous Years – Median Value				Baseline <sup>d</sup>
		Min	Max	Median	2000 <sup>c</sup>	1999 <sup>d</sup>	1998 <sup>d</sup>	1997 <sup>d</sup>	
JF-1	16	2392.8	2393.3	2393.1	2392.8	2392.7	2392.5	2392.4	2392.5
JF-2	16	2392.4	2393.2	2392.8	2392.7	2392.5	2392.1	2392.0	2392.1
JF-2a	16	2470.8	2471.1	2471.0	2470.6	2470.2	2470.0	2469.5	2468.6
J-13	16	2390.1	2390.9	2390.5	2390.2	2390.0	2389.8	2389.6	2390.0
J-11	16	2402.3	2403.0	2402.7	2402.4	2402.4	2402.6	2402.6	2402.2
J-12	16	2388.3	2388.6	2388.5	2388.4	2388.3	2388.0	2388.0	2388.3
JF-3	13	2388.3	2388.6	2388.5	2388.4	2388.2	2388.0	2388.0	2388.3

NOTES: <sup>a</sup> Values are presented in the unit of measure reported to regulatory agencies.

<sup>b</sup> Source: Wade 2001b, 2001c, 2001d, 2002h.

<sup>c</sup> Source: YMP 2001c, Table 4.

<sup>d</sup> Source: Locke 2001. Table 10 (baseline years are 1985-1991 for JF-2, JF-2, and JF-2a; 1989-1991 for J-13; 1990-1991 for J-1 and J-12; and 1992-1993 for J-3).

### 3.8 HAZARDOUS MATERIALS MANAGEMENT AND POLLUTION PREVENTION

#### 3.8.1 Hazardous Materials

To minimize the potential hazards of chemicals to Project personnel and the environment, a review of all proposed uses of hazardous materials is required before purchase or use on the YMP. To initiate this review, a request for authorization must be submitted prior to the purchase of any hazardous material. The request, along with Material Safety Data Sheets and chemical databases, are then reviewed to identify requirements, potential environmental hazards, and health and safety risks. When reasonable, suitable substitutes are discussed with the requester. If no substitute is available, authorization to use the material may be denied, or requirements for the use of the material to minimize risks are developed (e.g., storage methods, personal

protection equipment and handling requirements, training, spill prevention methods, waste disposal).

These requirements are incorporated into work instructions governing the use of the materials, as part of the Project's ISMS program. Surveillances (Section 3.10) are conducted periodically to ensure that these procedures are followed.

All chemicals stored at Yucca Mountain and other Project sites are inventoried and tracked. This information is used to comply with the requirements of EPCRA and Nevada regulations (NAC 477) (Section 2.7.3), including compilation of a list of specified hazardous materials (Table 5).

### **3.8.2 Waste Management**

**Hazardous and Universal Waste**—To meet the requirements of RCRA (Section 2.7.4), all hazardous and universal wastes are accumulated, packaged, transported, and disposed of offsite in accordance with federal and state requirements (Section 2.7.4). These wastes were generated from sources such as laboratory studies, routine cleaning and maintenance, construction, and excess supplies from discontinued equipment. During 2001, two shipments of hazardous waste, totaling 311 kg (685 lbs), were transported to an EPA-permitted treatment, storage, disposal, and recycling facility. This is 779 kg (1,717 lbs) less hazardous waste than was generated and shipped during 2000. One shipment of universal waste, totaling 343 kg (756 lbs), was shipped offsite (Table 6).

**Non-hazardous Waste**—During 2001, refuse, industrial, salvageable, and other non-hazardous waste were recycled, reused, or disposed of (Table 6) in accordance with federal and state requirements (Section 2.7.4). As part of the YMP pollution prevention program (Section 3.8.3), efforts were made to recycle, rather than dispose of, waste whenever possible.

Table 5. Maximum Quantity of Hazardous Materials Stored at Yucca Mountain During 2001

Category <sup>a</sup>	Material	EHS <sup>b</sup>	Max Qty <sup>c</sup>
C.7	Acetylene		8,850 cubic ft
C.7	Argon		225 cubic ft
C.7	Carbon Monoxide		60 cubic ft
C.7	HFC-134A (1,1,1,2-Tetrafluoroethane)		30 lbs
C.7	Hydrogen Sulfide in Nitrogen		11 cubic ft
C.7	Nitrogen		800 cubic ft
C.7	Nitrogen Dioxide in Nitrogen	X	14 cubic ft
C.7	R-12 (Dichlorodifluoromethane)		205 lbs
C.7	Oxygen		8,599 cubic ft
F.3	Acetone		122 lbs
F.3	Cooler Coating (petroleum distillate)		64 lbs
F.3	Diesel Fuel		32,436 lbs
F.3	DP-Lubricant Blue (Ethanol)		40 lbs
F.3	Devco Primer #2110 (Stoddard Solvent)		1,429 lbs
F.3	Extender Oil #2516 (Stoddard Solvent)		927 lbs
F.3	Gasoline		63,590 lbs
F.3	Isopropyl Alcohol		127 lbs
F.3	Kerosene		404 lbs
F.3	Lacquer Thinner (Bortz 666B)		
F.3	Methanol		
F.3	Mineral Spirits		
F.3	Paint (Devguard)		578 lbs
F.3	PF Degreaser (Degreaser Solvent)		76 lbs
F.3	Primer (Devguard)		710 lbs
F.3	PVC Cement		240 lbs
F.3	PVC Primer		115 lbs
F.3	QB-300 Adhesive (Treated Heavy Naphtha)		48 lbs
F.3	Tempil 2500, White (Xylene)		115 lbs
F.3	Toluene		38 lbs
H.1	Antifreeze		7,699 lbs
H.1	Cement		267,600 lbs
H.1	Greases, Lubricants, Oils		48,740 lbs
H.1	Hydrochloric Acid		350 lbs
H.1	Lithium Bromide		52,391 lbs
H.1	Nitric Acid	X	2 lbs
H.1	Sodium Hydroxide		1,005 lbs
H.1	Sulfuric Acid	X	4,537 lbs
H.1	Terraset Part A (Sodium Silicate)		6,614 lbs
H.1	Terraset Part B (Glycerol Esters)		5,071 lbs
H.1	Waste Oil		12,257 lbs
H.1	Americium-241 (sealed source)		4.90E+03 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.92E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.92E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.87E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.92E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.87E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		9.55E+02 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.86E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.89E+01 mCi



Table 5. Maximum Quantity of Hazardous Materials Stored at Yucca Mountain during 2001 (Continued)

Category <sup>a</sup>	Material	EHS <sup>b</sup>	Max Qty <sup>c</sup>
H.1	Americium-Beryllium-241 (sealed source)		4.86E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.93E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.93E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.88E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		9.88E+02 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.86E+01 mCi
H.1	Cesium-137 (sealed source)		1.95E+02 mCi
H.1	Cesium-137 (sealed source)		2.67E+01 mCi
H.1	Cesium-137 (sealed source)		6.80E+00 mCi
H.1	Cesium-137 (sealed source)		3.45E+00 mCi
H.1	Cesium-137 (sealed source)		7.06E+00 mCi
H.1	Cesium-137 (sealed source)		3.38E+01 mCi
H.1	Cesium-137 (sealed source)		8.23E+00 mCi
H.1	Cesium-137 (sealed source)		8.36E+00 mCi
H.1	Europium-152 (sealed source)		3.34E+00 mCi
H.1	Nickel-63 (sealed source)		4.86E+00 mCi
L.1	Propane		158 lbs

NOTES: <sup>a</sup>C.7 = Compressed gases at normal temperatures and pressures, F.3 = Flammable or combustible liquids, H.1 = Other hazardous materials, L.1 = Liquified Petroleum Gas.

<sup>b</sup>EHS = Extremely Hazardous Substance, per EPCRA Section 302.

<sup>c</sup>Values are presented in the unit of measure reported to regulatory agencies.

Table 6. Types and Amounts of Hazardous, Universal, and Non-hazardous Wastes Recycled, Reused, or Disposed of During 2001

Material	Method	Amount <sup>a</sup>
<b>Hazardous Waste</b>		
Ignitable liquid (aerosol cans) <sup>b</sup>	Disposed	309 lbs
Corrosive liquid (nitric acid) <sup>b</sup>	Disposed	72 lbs
Ignitable liquid (lacquer thinner) <sup>b</sup>	Disposed	3 lbs
Ignitable liquid (isoparaffinic hydrocarbons) <sup>c</sup>	Disposed	259 lbs
Ignitable liquid (isopropanol, n-hexane) <sup>c</sup>	Disposed	18 lbs
Ignitable liquid (aerosol cans) <sup>c</sup>	Disposed	24 lbs
<b>Universal Waste</b>		
Fluorescent lamps <sup>b</sup>	Recycled	638 lbs
Nickel-cadmium batteries <sup>b</sup>	Recycled	118 lbs
<b>Non-hazardous Waste</b>		
Debris (hydrocarbon-contaminated)	Disposed	36 cubic yards
Industrial solid waste	Disposed	305 tons
Refuse (Las Vegas)	Disposed	731 tons
Refuse (Site)	Disposed	33 tons
Sanitary wastes (portable toilets)	Disposed	21,266 gallons
Tires (non-recyclable)	Disposed	3
Aluminum cans	Recycled	1,102 lbs
Antifreeze	Recycled	270 gallons
Cardboard	Recycled	2,645 lbs
Copy machine and printer toner cartridges	Recycled	1,806 each
Ferrous and non-ferrous metals (does not include aluminum cans)	Recycled	203 tons
Lead-acid batteries	Recycled	21.04 tons
Paper	Recycled	347.33 tons
Soil (hydrocarbon-contaminated)	Recycled	24 cubic yards
Tires (truck and heavy-equipment)	Recycled	127
Used oil from equipment maintenance	Recycled	2,370 gallons
Used oil from oil/water separator	Recycled	110 gallons
Used oil total	Recycled	2,480 gallons
Water (oil/water separator)	Recycled	93,000 gallons
Used notebook binders	Reused	574
Used computers	Reused	208

NOTES: <sup>a</sup>Values are presented in the unit of measure reported to regulatory agencies.

<sup>b</sup>Shipped offsite from Yucca Mountain.

<sup>c</sup>Shipped offsite from Las Vegas offices.

### 3.8.3 Pollution Prevention

The pollution prevention program is described in the *Waste Minimization and Pollution Prevention Awareness Plan* (YMP 2001d). This plan was reviewed and updated during 2001 in accordance with DOE Order 5400.1. The plan establishes (1) a pollution prevention committee, (2) reporting and record-keeping requirements, and (3) requirements for pollution prevention opportunity assessments. The pollution prevention committee includes representatives from key departments representing the range of disciplines and activities throughout the YMP. The committee meets quarterly, reviews operations, discusses ways to increase employee awareness, suggests ideas for pollution prevention opportunity assessments, identifies attainable action items from established pollution prevention goals, identifies potential waste-reduction activities, and tracks performance of the program.

**Reporting and Record Keeping Requirements**—EO 13101 (Section 2.1.5) requires that each federal agency purchase, to the greatest extent practicable, EPA-designated products containing recovered materials (40 CFR 247). The YMP goal is to eventually purchase 100 percent of such items. During Fiscal Year 2001, the YMP affirmative procurement program attained approximately 76 percent compliance with this goal. An affirmative purchasing report summarizing this information was prepared as required by EO 13101 (Sorensen 2001b).

An Annual Report on Waste Generation and Pollution Prevention Progress summarized quantities of waste generated and recycled, and waste minimization activities and accomplishments during fiscal year 2001 (Wade 2001e). Because some waste management and recycling functions for the YMP were performed by the DOE contractor for the NTS, some YMP waste and recycling efforts (e.g., recycling of scrap iron) were reported by that organization. The YMP therefore coordinated with personnel from the NTS during preparation of that report.

The Waste Minimization Plan (YMP 2001d) requires preparation of an annual waste management report. This report describes each of the YMP waste management and recycling activities (McCann 2002). The YMP released to other government agencies or to the public approximately 2,100 items having a value of over 11 million dollars.

**Pollution Prevention Opportunity Assessments**—During 2001, two pollution prevention opportunity assessments were initiated. One assessment addressed recycling efforts at Yucca Mountain. In this assessment, the establishment of centralized recycling locations and the assignment of data-collecting and reporting responsibilities were evaluated. The second assessment evaluated additional recycling opportunities at the YMP's Las Vegas facilities. As a result, additional recycling efforts are being pursued.

**Employee Awareness Initiatives**—Efforts to expand the awareness of the YMP pollution prevention program were increased in 2001. These efforts included responding to requests for training and information, updating training to include compliance with "Greening the Government" EOs, participating in reviews of BSC purchasing procedures, increasing participation in the pollution prevention committee, developing awareness campaigns for the affirmative procurement program, presenting at staff meetings, and producing Project-wide notices.

**Affirmative Procurement Program**—Procurement and tracking of items listed in the Consumer Product Guideline developed by the EPA were reviewed in 2001. As a result, procurement procedures and forms were modified to more clearly emphasize the requirement to purchase these products, and personnel most likely to procure these items were trained. An evaluation of these new procedures will be conducted in 2002.

**DOE Secretarial Pollution Prevention and Energy Efficiency Goals**—The YMP initiated or continued numerous activities in 2001 to reduce pollution, increase energy efficiency, and phase out the use of ozone-depleting substances, as directed by the DOE *Pollution Prevention and Energy Efficiency Leadership Goals at Department of Energy Facilities* (Richardson 1999).

The hazardous material approval process (Section 3.8.1) is followed to reduce the use and generation of hazardous and toxic substances. The YMP did not manufacture, process, or otherwise use any chemical regulated under Section 313 of EPCRA in excess of threshold quantities during 2001, and there was a reduction of 779 kg (1,717 lbs) in the amount of hazardous waste generated during 2001 compared to 2000. Two pollution prevention opportunity assessments were initiated in 2001 to evaluate ways to increase recycling of certain waste streams and reduce the amount of sanitary waste sent for disposal.

Because of improvements in the affirmative procurement program, purchases of items manufactured with recycled content increased to 76 percent, up approximately 20 percent from 2000.

To improve energy efficiency, opportunities for reducing energy use were identified in 2001. These included incorporating requirements for energy efficiency upgrades into lease renewals for properties leased by the YMP in Las Vegas, requiring employees to shut down unnecessary equipment during non-working hours, and purchasing energy efficient equipment.

To evaluate use of ozone-depleting substances and generation of greenhouse gases, use and storage of Class I ozone-depleting substances was monitored during 2001.

To increase vehicle fleet efficiency and the use of alternative fuels, the Project replaced 11 vehicles with small sedans that have better fuel efficiency and are converted to use compressed natural gas. In addition, many large or 4-wheel-drive trucks in the YMP's Las Vegas motorpool were replaced with lighter duty vehicles.

### 3.9 ES&H ASSESSMENTS

The ES&H assessment program is conducted to fulfill DOE Policy 450.5 (Section 2.8) and requirements outlined in the *Environmental Management Plan* (YMP 2000b) and the *Yucca Mountain Site Characterization Project Requirements Document* (YMP 2001a, Section 7). These assessments provide programmatic oversight of YMP activities to ensure full compliance with regulations and excellence in the ES&H and ISMS programs. This is accomplished through independent evaluations of YMP ES&H activities and programs for compliance with applicable federal and state laws; DOE directives; permit stipulations; and YMP plans, policies, and procedures. As a result, the assessment process, which includes verification, validation, and closure of corrective actions, enhances the effectiveness and implementation of ES&H roles and responsibilities among YMP organizations.

Assessment topics are selected based on requirements for periodic program reviews, the potential for noncompliance conditions, management requests, or the need to evaluate newly implemented or changed programs. Assessments are conducted through document reviews, observation of work practices, and interviews to evaluate compliance with the governing regulatory and procedural requirements. Assessment results, including non-compliance findings and opportunities for improvement, are documented in an assessment report that is distributed to affected managers. Those managers must then address the findings through development and implementation of corrective actions. Assessments are closed when the completion of these actions is verified by the Lead Assessor and validated by the YMSCO Office of Project Execution.

During 2001, eight assessments were conducted to evaluate compliance with ES&H requirements relating to packaging and transportation safety, lessons learned program, fall protection and scaffolding, ES&H committee system, motor vehicle safety, occupational safety and health, the annual review<sup>9</sup> of ISM implementation, and the environmental reclamation program (Table 7).

Table 7. 2001 Assessment Results

Assessment	Results
Packaging and Transportation Safety (00-04)	U.S. Department of Transportation packaging and transportation-safety program requirements were evaluated. Corrective actions resulted in a more formalized program that complies with DOE regulatory requirements.
Lessons Learned (01-05)	The Lessons Learned program, including participation by both YMSCO and BSC personnel, was evaluated. Increased support of program goals and objectives by senior management and lessons-learned coordinators resulted in greater program visibility and participation.
Fall Protection and Scaffolding (01-06)	Procedural requirements and work-planning processes for fall protection and scaffolding requirements were evaluated. Procedures were revised, and work processes were improved to more fully address measures for fall protection and scaffolding safety.
ES&H Committee Program (01-07)	The ES&H Committee system was assessed and found to lack full participation by all BSC organizations. The committee system was restructured to establish the President's Zero Accident Council and individual organizational Zero Accident Committees to better promote ISMS goals and objectives.
Motor Vehicle Safety (01-08)	Motor vehicle safety and inspections was audited. Use of vehicle inspection checklists was implemented, and instructions regarding breakdowns were placed in all vehicles.
Occupational Safety and Health (01-09)	Timely feedback and/or lessons learned were not provided to BSC employees on accident/incident information to help prevent reoccurrences. Case management was improved to include dissemination of appropriate accident/incident information to employees through electronic announcements.
ISMS Annual Review (01-11)	Deficiencies were noted in site management enforcement of procedural compliance. Initiatives are being implemented to improve procedural adherence to work planning/performance procedures, tracking of self-assessment information, performance indicator metrics, and independent oversight of non-quality affecting activities.
Environmental Reclamation Program (02-01)	This assessment concluded that BSC has established and implemented a very effective and well-documented environmental reclamation program that fully meets the intent of federal regulations and DOE directives for restoring and enhancing environmental quality.

### **3.10 ENVIRONMENTAL SURVEILLANCE PROGRAM**

Environmental surveillances are conducted to confirm that activities are planned, managed, and implemented in a manner that protects environmental quality, minimizes threats to the environment, and complies with programmatic requirements and permit stipulations. Surveillances may investigate, among other things, procedural requirements (e.g., DOE directives, YMP plans and procedures), permit conditions, land access stipulations, and environmental regulations. Most surveillances are planned in advance; however, surveillance reports and associated corrective actions are also written whenever an environmental compliance issue is noted or reported.

Five hundred and thirty-three environmental surveillance reports were completed in 2001. Positive observations or no environmental concerns were identified during 500 (94 percent) of the surveillances. This is a slight improvement over the rate of 91 percent during 2001. Of the 33 reports for which concerns were noted, 18 corrective actions were for spills and waste management and 15 were for non-compliance with procedures and plans. There were no permit violations or reportable spills.

Trends in corrective actions for permit compliance, spills and waste management, and procedural deficiencies are tracked as measures of environmental performance of the YMP. These trends are reported monthly. All trends were negative in 2001 (i.e., there was a decrease in the number of findings). This decrease in the number of surveillance reports requiring action indicates that changes in the work planning and implementation process in recent years have been successful. Closer attention to compliance with procedures and work instructions and greater worker involvement in the planning and conduct of the work have helped reduce the occurrence of corrective actions.

### **3.11 TRAINING**

Worker training on environmental compliance, pollution prevention, and all other aspects of integrated safety management is an important part of the YMP environmental program. All Project personnel working at Yucca Mountain are instructed on the environmental and safety requirements that must be followed for field activities, and additional job-specific training is offered commensurate with their job responsibilities.

All new employees must take Employee ES&H Training. This four-hour course covers, among other things, Project environmental protection requirements, hazard communication, waste minimization and pollution prevention, and safety and health requirements. A computer-based annual refresher of these topics also is required of all employees.

All new employees who work unescorted at Yucca Mountain must also take Site Access Training (previously called General Employee Training). This three-hour class describes employees' responsibilities for land access, protecting biological and cultural resources, hazardous and non-hazardous waste management, and environmental permit compliance. Computer-based, annual refresher training is also required. Three hundred and seventy-six employees took the classroom training and 557 took the refresher training during 2001.

Environmental Compliance Awareness for Managers and Supervisors is required for all managers and supervisors. This computer-based training informs managers and supervisors of their responsibilities for maintaining environmental compliance and protecting the environment, and the consequences of not taking environmental concerns seriously. Managers are instructed to minimize environmental impacts; comply with environmental regulations; and mitigate impacts through prevention, corrective action, reclamation, and other measures.

Employees whose work involves the transportation of hazardous materials are required to attend a three-day training class on the basics of hazardous materials transportation and to attend additional job-specific classes. Personnel are also required to attend a three-day advanced class if their work involves the certification of shipping papers for hazardous waste or radioactive materials.

A class in Leak Detection and Mitigation is required for employees whose work involves control and reporting of hazardous material spills. This two-hour class covers oil and hazardous materials in work areas; spill/release scenarios; spill response stations, equipment, and materials; and procedures for spill/release response, including health, safety containment, cleanup, notification, and reporting requirements.

#### 4. QUALITY ASSURANCE

The quality of environmental data and results presented in this report were ensured through QA practices. Appropriate industry standards and accepted laboratory and field monitoring practices were used to establish QA practices. These practices are compliant with permit requirements applicable to collection and analysis of environmental data. The QA practices were applied to the appropriate aspects of monitoring, sampling, analysis, data reduction, and reporting operations to produce data of known quality. Some aspects of the environmental program described in this report (i.e., radiological monitoring program support; meteorological monitoring and data analysis; tracers, fluids, and material reporting for reclamation) were also subject to the requirements of the *Quality Assurance Requirements and Description* (DOE 2000a), as determined by BSC (2001d, 2001e, 2001f).

The QA practices were implemented through the systematic application of QA policies, standardized procedures, and independent assessments. QA controls included the following:

- Personnel training was conducted and documented before work was initiated.
- Work instructions and procedures were developed and reviewed before they were approved for use.
- A verbatim compliance policy for work performance, in accordance with approved procedures, was mandated for all work.
- Standards traceable to the National Institute of Standards and Technology were used to calibrate and check measuring and test equipment.

- Equipment used for monitoring, sampling, analysis, and counting were regularly calibrated at prescribed intervals.
- Operational status and accuracy of equipment were independently and routinely checked by trained personnel.
- Discrepancies and nonconforming conditions, which may have affected data quality, were documented and evaluated in accordance with a structured and approved corrective action process.
- Technical data were reviewed before data reduction/analysis and reporting.
- Computer software used for data reduction and analysis were evaluated and controlled.
- Monitoring, sampling, analysis, and subsequent data reduction were periodically evaluated to verify effective implementation.
- Compliance with QA procedures for meteorological monitoring was verified by independent assessments.

**Sample Control**—All environmental samples were controlled in accordance with approved work instructions and procedures. These controlled procedures specified approved methods and processes for sample collection, sample handling, chain-of-custody control, and analysis and data reporting.

Technicians were trained to ensure that samples were properly labeled, stored, and protected against loss or contamination. Samples were uniquely identified by markings on either the sample or its packaging. Sample transactions were documented on either a "Chain-of-Custody" form for external transfers or a "Sample Transfer" form if transferred internally. Transfer recipients were required to verify that proper conditions and identification of samples were provided and maintained before accepting sample custody.

**Sample Analysis**—Analyses of samples were conducted in accordance with approved protocols, based on standard and approved methods. Personnel performing analyses and measurements were specifically trained for these work assignments before initiating work.

As prescribed by a scope of work, analysis programs selectively used sample blanks, spikes, and replicates to better determine accuracy and precision of methods and to eliminate bias. Subcontractors who measured or analyzed samples were required to establish an equivalent QA control system. Results of measurements and analyses were reviewed and approved by qualified personnel.

**Instrument Control**—Instruments used to measure, monitor, test, or sample environmental conditions were procured, calibrated, controlled, and maintained in accordance with approved procedures. Equipment and calibration standards used to ensure instrumentation accuracy were traceable to the National Institute of Standards and Technology. Frequency of equipment



calibration and maintenance were prescribed in approved procedures, based upon manufacturers' recommendations.

Performance of all calibrated equipment was periodically checked to verify adherence to operation specifications. Calibrated equipment was routinely checked by field technicians, and adjustments were made to optimize the performance. Out-of-tolerance conditions were documented, and resolution was determined by recalibration, rework, or replacement. Data affected by out-of-tolerance conditions were reported and identified as "indeterminate" until resolution of the condition had been evaluated and data could be validated.

**Data Management**—To preserve data integrity, monitoring and sampling data were recorded and handled in accordance with approved procedures. The efficiency of data reduction software was verified through formal acceptance tests before use.

During data reduction and compilation, data were validated to identify inconsistencies and anomalies. Data validation was performed by comparing the data to expected or predetermined ranges and past results. Decisions to include or eliminate suspect or unverifiable data were determined during technical reviews by qualified personnel.

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## **5.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES**

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10 CFR 963. Energy: Yucca Mountain Site Suitability Guidelines. Readily available.

10 CFR 1021. Energy: National Environmental Policy Act Implementing Procedures. Readily available.

10 CFR 1022. Energy: Compliance with Floodplain/Wetlands Environmental Review Requirements. Readily available.

33 CFR 320. Navigation and Navigable Water: General Regulatory Policies. Readily available.

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36 CFR 79. Parks, Forests, and Public Property: Curation of Federally-Owned and Administered Archaeological Collections. Readily available.

36 FR 8921. Protection and Enhancement of the Cultural Environment. Executive Order 11593. Readily available.

40 CFR 50. Protection of Environment: National Primary and Secondary Ambient Air Quality Standards. Readily available.

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40 CFR 144. Protection of Environment: Underground Injection Control Program. Readily available.

40 CFR 197. Protection of Environment: Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada. Readily available.

40 CFR 247. Protection of Environment: Comprehensive Procurement Guideline for Products Containing Recovered Materials. Readily available.

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60 FR 40164. Preparation of an Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. Readily available.

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63 FR 27655. Consultation and Coordination with Indian Tribal Governments. Executive Order 13084. Readily available.

63 FR 49643. Greening the Government through Waste Prevention, Recycling, and Federal Acquisition. Executive Order 13101. Readily available.

64 FR 6183. Invasive Species. Executive Order 13112. Readily available.

64 FR 30851. Greening the Government Through Efficient Energy Management. Executive Order 13123. Readily available.

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65 FR 24595. Greening the Government Through Leadership in Environmental Management. Executive Order 13148. Readily available.

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